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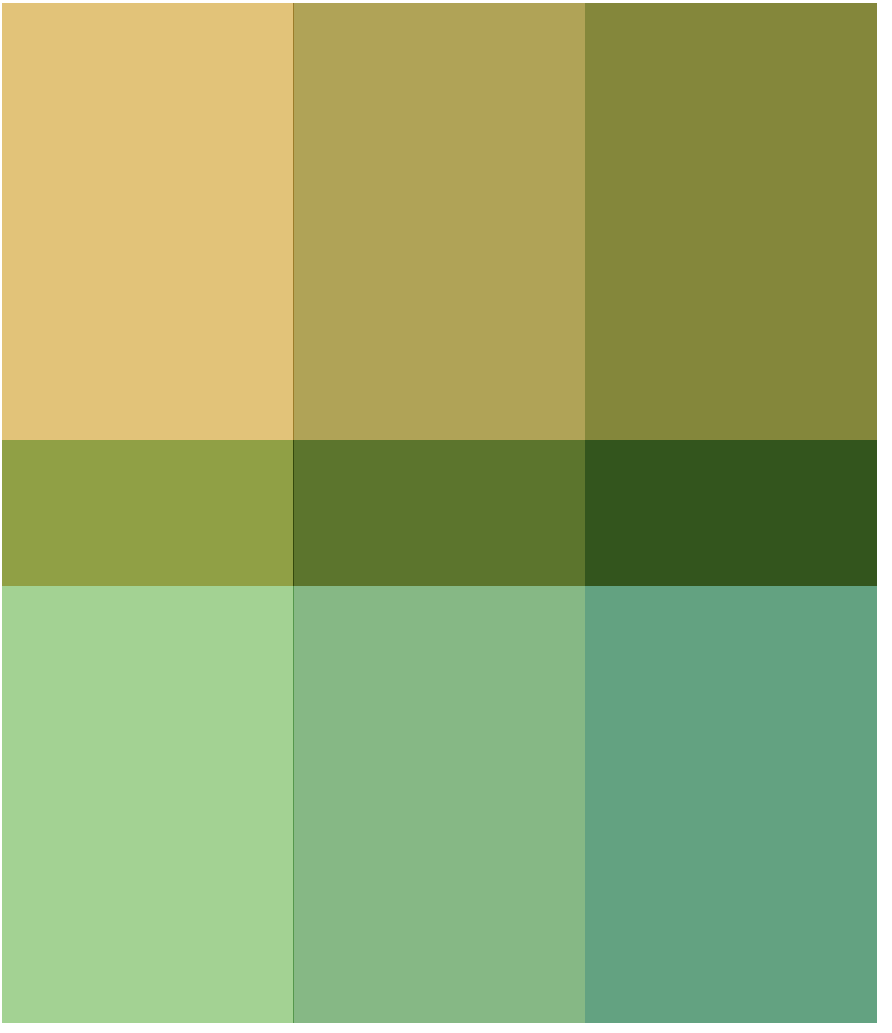

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The C·E·P·S Journal is an open-access, peer-reviewed journal devoted to publishing research papers in different fields of education, including scientific.

Aims & Scope

The C·E·P·S Journal is an international peer-reviewed journal with an international board. It publishes original empirical and theoretical studies from a wide variety of academic disciplines related to the field of Teacher Education and Educational Sciences; in particular, it will support comparative studies in the field. Regional context is stressed but the journal remains open to researchers and contributors across all European countries and worldwide. There are four issues per year, two in English and two in Slovenian (with English abstracts). Issues are focused on specific areas but there is also space for non-focused articles and book reviews.

About the Publisher

The University of Ljubljana is one of the largest universities in the region (see www.uni-lj.si for details) and its Faculty of Education (see www.pef.uni-lj.si), established in 1947, has the leading role in teacher education and education sciences in Slovenia. It is well positioned in regional and European cooperation programmes in teaching and research. A publishing unit oversees the dissemination of research results and informs the interested public about new trends in the broad area of teacher education and education sciences; to date, numerous monographs and publications have been published, not just in Slovenian but also in English.

In 2001, the Centre for Educational Policy Studies (ceps; see http://ceps.pef.uni-lj.si) was established within the Faculty of Education to build upon experience acquired in the broad reform of the national educational system during the period of social transition in the 1990s, to upgrade expertise and to strengthen international cooperation. CEPS has established a number of fruitful contacts, both in the region - particularly with similar institutions in the countries of the Western Balkans - and with interested partners in EU member states and worldwide.

Revija Centra za študij edukacijskih strategij je mednarodno recenzirana revija, z mednarodnim uredniškim odborom in s prostim dostopom. Namenjena je objavljanju člankov s področja izobraževanja učiteljev in edukacijskih ved

Cilji in namen

Revija je namenjena obravnavanju naslednjih področij: poučevanje, učenje, vzgoja in izobraževanje, socialna pedagogika, specialna in rehabilitacijska pedagogika, predšolska pedagogika, edukacijske politike, supervizija, poučevanje slovenskega jezika in književnosti, poučevanje matematike, računalništva, naravoslovja in tehnike, poučevanje družboslovja in humanistike, poučevanje na področju umetnosti, visokošolsko izobraževanje in izobraževanje odraslih. Poseben poudarek bo namenjen izobraževanju učiteljev in spodbujanju njihovega profesionalnega razvoja.

V reviji so objavljeni znanstveni prispevki, in sicer teoretični prispevki in prispevki, v katerih so predstavljeni rezultati kvantitavnih in kvalitativnih empiričnih raziskav. Še posebej poudarjen je pomen komparativnih raziskav.

Revija izide štirikrat letno. Dve številki sta v angleškem jeziku, dve v slovenskem. Prispevki v slovenskem jeziku imajo angleški povzetek. Številke so tematsko opredeljene, v njih pa je prostor tudi za netematske prispevke in predstavitve ter recenzije novih publikacij.

Contents

Varia

Reviews

Editors' Foreword

In a time of progressing globalisation and numerous changes in the area of education, grounded both nationally and internationally, from preschool to university level, educational research and discussion on open conceptual questions, as well as the communication of research results to a broad scientific audience, have become ever more important.

It is on this background that a decision was made at the Faculty of Education of the University of Ljubljana to establish a journal aimed at encouraging international dialogue between researchers. The University of Ljubljana is one of the largest universities in the region (see www.uni-lj.si for details). The Faculty of Education (see www.pef.uni-lj.si), established in 1947, is well positioned in regional and European cooperation programmes in teaching and research. In 2001, the Centre for Educational Policy Studies (CEPS; see http://ceps.pef.uni-lj.si) was established within the Faculty of Education to build upon experience acquired in the broad reform of the national educational system during the period of social transition in the 1990s, to upgrade expertise and to strengthen international cooperation. CEPS has established a number of fruitful contacts, both in the region - particularly with similar institutions in the countries of the Western Balkans - and with interested partners in EU member states and worldwide.

The idea of launching a new journal is a natural step from the existing practices and expertise. The CEPS Journal www.cepsj.si is an international peer-reviewed journal with an international board. It publishes original empirical and theoretical studies from a wide variety of academic disciplines related to the field of Teacher Education and Educational Sciences; in particular, it supports comparative studies in the field. Regional contexts are stressed but the journal remains open to researchers and contributors across all European countries and worldwide. There are four issues per year, two in English and two in Slovenian (with English abstracts).

I would like to take this opportunity to thank the contributing authors and the referees. I would also like to invite all interested researchers in the area of education and teacher education to send your contributions.

Milena Valenčič Zuljan
On behalf of the Editors

Editorial

The thematic focus of the first issue of the Centre for Educational Policy Studies Journal (CEPS Journal) is educational innovation, one of the crucial starting points for quality educational work in today's fast changing world. All over the world, there are many innovations in science and technology, changes in economics and politics, and transformations in demographical and social structures; the educational process needs to respond to these changes adequately. As early as in the 1960s, the professionals of the Club of Rome (Marentič Požarnik, 2000, p. 282) drew attention to the contrast between the limited natural resources and the unlimited possibilities of human learning. They stressed the meaning of innovative learning based on predicting the future, with an emphasis on creativity, long-lasting effects and the democratic collaboration of everybody connected with future decisions. Similarly, Instanc (2008) questions which competencies the children of tomorrow should develop and emphasises the meaning of critical thinking and an ability to solve problems, creativity, communication skills and mutual collaboration. In the Memorandum on Lifelong Learning, the Commission of the European Communities also accentuates the importance of innovations in teaching and learning, and of suitable circumstances for permanent learning for all social roles (Commission of the European Communities, 2000, p. 14).

When considering the necessity of educational innovations, besides rapid changes in information, many other reasons come to mind, such as research findings about quality instruction and learning, more and more demanding educational objectives and the growing heterogeneity of students. Moreover, there are elements of global competition between governments of different countries aiming at developing human resources and human capital, which is reflected in the increased measurement and comparison of school efficiency and effectiveness. National and international exams are thus becoming "part of the political debates about productivity and the globalization of educational objectives" (Jorgenson, 2006, p. 9).

With their readiness and motivation for quality teaching and other professional work, teachers clearly present the main incentive for innovation in educational practice on all school levels, from kindergarten to university.

Teachers need to be ready for lifelong learning and their work environment should be a safe place to "experiment" and introduce

professionally founded pedagogical changes. The main question is how to properly balance the demands for changes; on the one hand, they bring research excitement, extra work, uncertainty, doubt and the need for the argumentation and evaluation of changes, while, on the other hand, there is the need for organisational stability and the long-term consolidation of the changes introduced. Every introduced innovation demands an all-round evaluation of its effects.

The constant introduction of changes without allowing them to become established in practice and without evaluating their effects is professionally unacceptable.

The origins of educational innovation differ; in a broad social perspective they can be results of research on specific segments of the school system, students' results in international exams etc., while from the point of view of the individual teacher or group of teachers, innovation can be induced by curiosity, wanting to learn more about learning and teaching, or by recognising a problematic situation and dissatisfaction with the current situation on the school level, the broader professional level or the didactic level of the classroom. Didactic innovations are seen as the process of forming theoretically based and practically founded changes in instruction that result from intentional, planned and creative work of teachers and/or researchers, leading to improvement of current school practice on the levels of the teacher's didactical skills and his/her conceptions, standpoints and reflection, school climate, and the teacher's understanding of his/her own professional development.

Eight articles in the present issue discuss educational innovations. In the paper *Investigating the Effectiveness of a Dynamic Integrated Approach to Teacher Professional Development*, P. Antoniou, L. Kyriakides and B. Creemers propose a dynamic integrated approach to teacher professional development. This model was developed in order to establish links between educational effectiveness research and improvement practices. Teacher professional development is considered an essential mechanism for deepening teachers' content knowledge and developing their teaching practices in order to teach at a high standard. Despite the number of studies on teacher professional development, the majority of these studies do not measure the impact of different approaches and programmes on student learning outcomes. In this context, the present paper argues that research on teacher professional development should draw from validated theoretical models of educational effectiveness research in order to develop teacher professional

development programmes that will not only have an impact on improving teacher knowledge and skills but will ultimately raise educational standards. The results of an experimental study comparing the impact of different approaches to teacher professional development are presented in the paper. Teachers employing the dynamic integrated approach managed to improve their teaching skills and the use of this approach also had a significant impact on student achievements.

Studies and preparation for the future profession have a significant impact on the ability and willingness to research and investigate teaching and learning practice. In order for teacher training institutions to carry out their mission effectively, it is important that they monitor students and novice teachers and evaluate their level of achieving the intended competencies. In the article *Educating Student Teachers to Become High Quality Professionals – A Finnish Case*, H. Niemi presents the results of empirical research on a large number of student teachers aiming at the evaluation of competencies. They assessed how teacher education had provided them with the competencies they need in a high standard profession, what kinds of active learning experiences they had in their TE studies, and how research studies of teacher education had contributed to their professional development. The participants in the study assessed that they had achieved good skills in planning teaching and curriculum. They were capable of using different teaching methods. They were aware of their own teaching philosophy and their responsibilities as professionals and life-long learners. They consider the research component of TE valuable to their independent and critical thinking and they were very engaged in studies. The author concludes the article by suggesting basic principles of research-based teacher education.

Further on, we find three articles referring to science teaching. In their paper *Variations in Primary Teachers' Responses and Development During Three Major Science In-Service Programmes*, T. Jarvis, A. Pell and P. Hingley report on how different types of teachers responded to in-service aimed at developing investigative hands-on science in primary schools and the extent to which they applied their new skills in the classroom. Using cluster analysis enabled three teacher types to be identified: 'Science Unsures' with low attitude scores and little confidence, who showed no response to the innovation; 'Holistic improvers', who showed the largest improvement in science teaching confidence; and 'High level, positive progressives', who were very positive to science teaching throughout and showed gains in confidence in teaching

physics and chemistry as well as demonstrating the relevance of science to their pupils. Taking account of these teacher types alongside interviews and observations, nine developmental stages in how teachers apply their new expertise in the classroom and the whole school are suggested.

T. Feierabend and I. Eilks have contributed the article *Innovating Science Teaching by Participatory Action Research – Reflections from an Interdisciplinary Project of Curriculum Innovation on Teaching about Climate Change*, in which they describe a three-year curriculum innovation project on teaching about climate change. The innovation in this study focused on a socio-critical approach towards teaching climate change in different teaching domains. The teaching itself explicitly aimed at general educational objectives, i.e., fostering students' communication and evaluation abilities as essential components for preparing young people for active participation in society. Participatory Action Research has been used as a collaborative strategy of cyclic curriculum innovation and research. Core issues reflected upon include how the project contributed to the creation of feasible curriculum materials, how it led to innovative structures in practice, and whether it supported experienced teachers' ongoing professional development.

Using Technology to Engage Preservice Elementary Teachers in Learning about Scientific Inquiry, an article by L. Jones, J. MacArthur and S. Akaygun, stresses the meaning of one of the basic presumptions in teacher education: student teachers need to be trained in the way we expect them to teach their future pupils. Elementary teachers are often required to teach inquiry in their classrooms, although they have had little exposure to inquiry learning themselves. In a capstone science course, preservice elementary teachers experience scientific inquiry through the completion of group projects, activities, readings and discussion, in order to develop a sense of how inquiry learning takes place. At the same time, they learn science content necessary for teacher licensure. The course exposes students to different pathways of scientific discovery and to the use of the computer both as a tool for conducting inquiry-based investigations and as a means of collecting and sharing student opinions. The students have many misconceptions about science and it is often difficult for them to distinguish science from pseudoscience. Computer simulations are used to help students understand that difference.

Collaboration is of great importance in the process of pedagogical innovation. L. M. García has contributed the article *Encouraging Teachers' and Students' Innovation with the Support of Teacher Learning Communities*. The purpose of this paper is to share the knowledge generated through the implementation of "Teaching Innovation Teams" as a strategy for teachers' professional development and innovation at the University of Alcala. The author analyses the contributions of this strategy to facilitating curriculum innovation in higher education. She also reflects on some of the achievements and results of the activities carried out by these teams, identifying the dilemmas and difficulties teachers experienced that hinder the development of curriculum innovations. Finally, the author outlines some educational contributions of "Teaching Innovation Teams" understood as a collaborative and formative strategy to facilitate educational change.

Textbooks can have an important effect on the quality of instruction and students' individual learning. In the article *Exploring Culture in Locally Published English Textbooks for Primary Education in Turkey*, R. Ağçam and Y. Kirkgöz investigate the cultural elements in locally published English textbooks used in Turkish primary schools following two major curriculum innovations in ELT. A total of 18 textbooks, of which 8 were published after the 1997 curriculum innovation, and 10 after the curriculum innovation introduced in 2005, were investigated to find out the extent to which textbooks contain references to source (Turkish) culture, target (British/American) culture and the international target culture.

In an empirical study in which she researches postgraduate students' perceptions of (their own) creativity in research, Mojca Juriševič highlights the phenomenon of scientific creativity. She finds that on concluding their first year of study students perceive an encouraging scientific research climate, that they experience their research in a relatively creative way, and that they work primarily on the problem of "narrowing and elaborating their own research problem". On the basis of the research results, she suggests the systematic encouragement of students in the area of the application of various study strategies, and proposes the use of highly competent and scientifically creative higher education teachers for mentorship in the research work of postgraduate students.

There is one further contribution in the non-focused part of the journal. In their article, *Personal and Emotional Factors in the Labour Integration of University Graduates in the Field of Education*

- *Implications for University Teaching*, J. L. Castejón, R. Gilar and P. Miñano analyse the role of intellectual, personal and emotional competencies as well as technical knowledge - academic achievement - in the employment of university graduates, with the purpose of incorporating these competencies into training programmes developed within the European framework of higher education. They attempt to identify the key socio-emotional competencies in the field of education in order to establish the implications of including this type of skill in university training programmes within the European Higher Education Area.

In the third part, there are reviews of two monographs, *Teacher Competencies and Educational Goals* (2010). (Peklaj, C. (Ed.). Aachen: Shaker Verlag, ISBN 978-3-8322-9661-2) and *Resilience in Action* (2007) (Nan Henderson (Ed.). Paso Robles, CA: Resiliency in Action, Inc., ISBN 0-9669394—3-3).

Milena Valenčič Zuljan and Janez Vogrinc

References

Commission of the European Communities (2000). *A memorandum on Lifelong Learning.* Brussels.

IInstance, D. (2008). *Promoting Innovation and Creativity: Schools' response to the Challenges of future Societies.* Conference held on 8-10 April, Brdo, Slovenia.

Jorgenson, O. (2006). Why Curricular Change is Difficult – and Necessary. *Independent School*, 65(4), 3-10.

Marentič-Požarnik, B. (2000). *Psihologija učenja in pouka*. Ljubljana: DZS.

Investigating the Effectiveness of a Dynamic Integrated Approach to Teacher Professional Development

Panayiotis Antoniou*[1], Leonidas Kyriakides[2] and Bert Creemers[3]

This paper argues that research on teacher professional development could be integrated with validated theoretical models of educational effectiveness research (EER). A dynamic integrated approach (DIA) to teacher professional development is proposed. The methods and results of a study comparing the impact of the DIA and the Holistic - Reflective Approach (HA) to teacher professional development are presented. Teaching skills and teacher perceptions of teaching of 130 teachers and the achievement of their students (n=2356) were measured at the beginning and at the end of the intervention. Teachers found to be at a certain developmental stage were randomly allocated evenly into two groups. The first group employed the DIA and the second the HA. Teachers employing the DIA managed to improve their teaching skills more than teachers employing the HA. Teacher perceptions and attitudes towards teaching have not been modified due to their participation in the interventions. On the other hand, the use of DIA also had a significant impact on student achievement. Implications of findings for the use of EER for improvement purposes are drawn and suggestions for research and practice in teacher professional development are provided.

Keywords: Dynamic integrated approach, Educational effectiveness research stages of teaching skills, Evaluation of teacher improvement, Teacher professional development

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Introduction

This research is in line with the current approaches of merging the findings of Educational Effectiveness Research (EER) with initiatives to improve education and particularly teacher effectiveness. Many researchers (e.g., Creemers & Reezigt, 1997; Reynolds, Hopkins & Stoll, 1993) have identified that an important constraint of the existing approaches of modelling educational effectiveness is the fact that the whole process does not contribute significantly to the improvement of teaching practice. Taking this into consideration, this study aims to contribute to further development of the framework related to the use of the dynamic model of EER (Kyriakides & Creemers, 2008) for improvement purposes.

Teacher professional development is considered an essential mechanism for deepening teachers' content knowledge and developing their teaching practices in order to teach to high standards (Borko, 2004; Day, 1999). Despite the number of studies on teacher professional development (e.g., Cohen, 1990; Desimone et al., 2002; U. S. Department of Education, 1999) the majority of these studies do not measure the impact of different approaches and programmes on student learning outcomes (Cochran-Smyth & Zeichner, 2005). While those responsible for professional development have generally assumed a strong and direct relationship between professional development and improvements in student learning, few have been able to describe the precise nature of this relationship (Guskey & Sparks, 2002). On the other hand, EER addresses questions as to what works in education and why, and refers to specific factors concerned with quality of teaching associated with student achievement.

In this context, the present paper argues that research on teacher professional development should draw from validated theoretical models of EER in order to develop teacher professional development programmes that will not only have an impact on improving teacher knowledge and skills but will ultimately raise educational standards. By establishing links between EER and research on teacher professional development, both fields could enjoy mutual benefits. In particular, research on teacher professional development could expand its research agenda by taking into consideration the impact of effective programmes on student outcomes, while at the same time EER could identify the extent to which its validated theoretical models can be used for improvement purposes. In this way, stronger links between research, policy and improvement of teaching practice could be established.

This paper presents the results of an experimental study comparing the impact of different approaches to teacher professional development upon the development of: a) teaching skills, b) teacher perceptions of teaching and c) student achievement gains in mathematics. Specifically, the holistic approach (based on teacher reflection), which is considered to be the dominant approach to teacher professional development, and the dynamic integrated approach (based on the groupings of teacher factors of the dynamic model). The methodology of the group-randomisation study, the results and the implications for the development of research and policy on teacher professional development are presented in the following sections.

The Holistic / Reflective Approach

The dominant approach in teacher professional development is focused on encouraging reflection on teaching practices, experiences, and beliefs (Golby & Viant, 2007). As Charlene (2008) argues, motivated by the need to prepare their citizens for a knowledge-based economy, many governments are striving to improve their schools by encouraging reflection among teachers. According to Elliot (2002), the expertise of teachers and the extent to which they can improve relates to their ability to continuously question and interrogate the terms and conditions that govern their own transactions with students. In this perspective, Van Manen (2002) proposes three levels of reflectivity: technical reflection, practical reflection and critical reflection. Technical reflection is concerned with techniques and strategies for specific goals, while critical reflection examines broader ethical issues. Situated between these two types of reflection is practical reflection, which goes beyond looking at skills, strategies and rules to question the goals themselves. Emphasis is also given to approaches involving the reflective capabilities of observation, analysis, interpretation and decision-making (Schon, 1983; Zeichner, 1987), which enable teachers to critically review their teaching practice. In addition, this approach involves making use of readings of journal writings, observation notes, transcribed conversations, videotaped analyses and self-regulation (Cornford, 2002).

Although reflection has been very fashionable in all sectors of teacher education for a number of years, there is little solid empirical evidence that supports the view that it results in an improvement of teaching practices (Cornford, 2002; McNamara, 1990). One would

have anticipated that there would have been concerted efforts to evaluate the practical effectiveness of these various approaches to reflection by empirical methods, but this has not occurred to any appreciable degree (Cochran-Smyth & Zeichner, 2005).

The results from the few published empirical studies that have attempted to quantify the effects of reflective thinking programmes on teacher thought and classroom performance are rather disappointing (Winitzky & Arends, 1991). Chandler et al. (1991) found reflection not to be significantly related to teaching performance. In addition, Wubbels and Korthagen (1990), comparing teachers who had graduated recently and some time before from conventional colleges and colleges implementing reflective teaching programmes found no differences between the two groups in attitude to reflection and inclination towards innovation. While there is some evidence that the reflective approach in some studies can produce greater ability to verbalise (Stoiber, 1991), there is no clear evidence that this can be carried through to superior practical teaching performance.

Finally, defining what actually constitutes reflective practices is fraught with difficulty (see Hatton & Smith, 1995; Tom, 1985). According to Cornford (2002), the ideals or purposes of reflection in education are as manifold as the term itself: development of self-monitoring teachers, teachers as experimenters, teachers as researchers and teachers as inquirers. The above terms associated with reflective teaching have varied both in terms of their conception of the nature of reflective activity and of the content on which teachers are expected to reflect (Calderhead, 1989).

Due to this, it is not always clear exactly what teachers are supposed to reflect on when trying to become better teachers, which is why the main critique of the reflective paradigm is that reflective approaches lack a grounded theoretical base on which specific teaching skills could be developed. Taking this into consideration, the present paper argues that EER, and especially the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008), could be used for developing an integrated approach to teacher professional development.

The Dynamic Integrated Approach

The dynamic model of educational effectiveness was developed in order to establish links between EER and improvement practices (Creemers & Kyriakides, 2006). In relation to the teacher level, the

dynamic model refers to eight factors that describe teachers' instructional role and are associated with student outcomes: orientation, structuring, questioning, teaching-modelling, applications, management of time, teacher role in making the classroom a learning environment, and classroom assessment. These eight factors do not refer only to one approach of teaching, such as the direct teaching model or the new teaching approach. An integrated approach in defining quality of teaching is adopted.

The dynamic model is also based on the assumption that although there are different effectiveness factors, each factor can be defined and measured using five dimensions: frequency, focus, stage, quality and differentiation. Frequency is a quantitative way to measure the functioning of each effectiveness factor, and studies within the process-product paradigm were only concerned with this dimension. The other four dimensions examine qualitative characteristics of the functioning of the factors and help us describe the complex nature of effective teaching (for further information on the conceptual background of the teacher factors of the dynamic model and the five measurement dimensions see Creemers & Kyriakides, 2008).

Another main assumption of the model is that these factors and their dimensions may be interrelated, and the importance of grouping specific factors for explaining achievement gains has been investigated. In particular, a longitudinal study revealed that the teacher factors of the dynamic model can be grouped into five levels, which are situated in developmental order (Kyriakides, Creemers & Antoniou, 2009). Table 1 demonstrates how the 42 teaching skills emerging from the dynamic model are grouped into these five stages.

Table 1. The five developmental stages of teaching skills included in the Dynamic Model

STAGES	TEACHING SKILLS
1 Basic elements of direct teaching	— Frequency management time — Stage management of time — Frequency structuring — Frequency application — Frequency assessment — Frequency questioning — Frequency teacher-student relation
2 Putting aspects of quality in direct teaching and touching on active teaching	— Stage structuring — Quality application — Stage questioning — Frequency student relations — Focus application — Stage application — Quality of questions
3 Acquiring quality in active/direct teaching	— Stage student relations — Stage teacher-student relation — Stage assessment — Frequency teaching modelling — Frequency orientation — Focus student relations — Quality: feedback — Focus questioning — Focus teacher-student relation — Quality structuring — Quality assessment
4 Differentiation of teaching	— Differentiation structuring — Differentiation time management — Differentiation questioning — Differentiation application — Focus assessment — Differentiation assessment — Stage teaching modelling — Stage orientation
5 Achieving quality and differentiation in teaching using different approaches	— Quality teacher-student relation — Quality student relations — Differentiation teacher-student relation — Differentiation student relations — Focus orientation — Quality orientation — Differentiation orientation — Quality of teaching modelling — Focus teaching modelling

Looking at the description of these five levels in terms of the teaching skills situated in each level, one can observe that the first three levels are mainly related to the direct and active teaching approach by moving from the basic requirements concerning quantitative characteristics of teaching routines to the more advanced requirements concerning the appropriate use of these skills as measured by the qualitative

characteristics of these factors. These skills also gradually move from the use of teacher-centred approaches to the active involvement of students in teaching and learning. The last two levels are more demanding since teachers are expected to differentiate their instruction (level 4) and also to demonstrate their ability to use the new teaching approach. Furthermore, taking student outcomes as criteria, teachers who demonstrate competencies in relation to higher levels were found to be more effective than those situated at the lower levels. This association is found for achievement in different subjects and for both cognitive and affective outcomes (Kyriakides, Creemers, Antoniou, 2009).

Specific strategies for improving effectiveness that are more comprehensive in nature may emerge by looking at the grouping of teacher factors of the dynamic model. In this context, Creemers, Kyriakides and Antoniou (in press) develop the DIA to teacher professional development. It is argued that teacher professional development should be focused on how to address specific groupings of teacher factors associated with student learning rather than with an isolated teaching factor or with the whole range of teacher factors (as implied by the Reflective Approach) without considering the professional needs of student teachers and teachers. Each grouping of factors refers to different developmental stages of teacher professional behaviour and the dimensions used to measure their functioning may help us develop programmes assisting teachers to improve their teaching skills by moving from easier to more complicate stages.

The *dynamic* dimension of this approach is attributed to the fact that its content derives from the grouping of teaching skills included in the dynamic model, while at the same time it is differentiated to meet the specific needs and priorities of teachers who were found to be situated in each developmental stage. Similarly, the integrated dimension of this approach is attributed to the fact that although its content refers to teaching skills that were found to be positively related to student achievement (drawn from EER) the participants are also engaged in systematic critical reflection upon these teaching skills (drawn from their experiences and perceptions).

Methods

A group randomisation study was conducted in order to compare the impact of the HA and the DIA approaches. Information about the participants, the four phases of the study and the research measures is provided below.

Participants

A total number of 130 teachers volunteered to participate in the professional development programme. Although the sample was not randomly selected, it was representative of the teacher population of Cyprus in terms of gender (χ^2=0.84, d.f.=1, p=0.42) and years of experience (t=1.21, d.f. =1835 , p=0.22). Data were also collected from all students (n=2356) of the teacher sample. The student sample was representative of the elementary school student population of Cyprus in terms of gender (χ^2=0.89, d.f.=1, p=0.43).

Data were collected both at the beginning and at the end of the intervention. Students with missing prior attainment or background data represented less than 7% of the original sample and were therefore excluded from each analysis. In regard to the teacher sample, only seven teachers left the experimental study. These teachers were equally distributed through the two intervention groups and the stage at which they were found to belong.

Phases of the study

The four phases of the experimental study are elaborated below.

Phase 1: Initial evaluation

At the beginning of the 2008-2009 school year, the teaching skills of the participants were evaluated by external observers. Data on student achievement were collected using external written forms of assessment designed to assess knowledge and skills in mathematics as identified in the Cyprus Curriculum (Ministry of Education, 1994). Teacher questionnaires were administered in order to collect data on teacher background characteristics and measure their perceptions of teaching. In addition, a student questionnaire was administered in order to collect information related to student background characteristics. Observation data were then analysed using the same procedure as described by Kyriakides et al. (2009) in order to classify teachers into developmental stages according to their teaching skills. Using the Rasch and the Saltus models, it was found that teachers could be classified into the same five developmental stages that had emerged from the previous study (see table 1).

Phase 2: The formation of the two experimental groups

The teachers who were found to be at a certain developmental stage were randomly allocated into two teams of equal size. The first

team employed the DIA and the second the HA. For example, the 32 teachers who proved to be at Stage 1 were randomly allocated into two experimental groups, each consisting of 16 teachers.

Phase 3: Establishment of training sessions

In this phase, the teachers of each experimental group had to attend nine sessions, as described below:

i) First Session

The first session was a common/introductory session for all of the teachers of our sample and took place before the initial evaluation (phase 1). In this session the main phases of the professional development programme were analysed. The importance of evaluating the impact of this professional development programme was stressed. It was made clear that provisions had been taken to ensure the anonymity and confidentiality of the evaluation results. Finally, training on how to develop an action plan was provided.

ii) Sessions for teachers employing the DIA

At the second session, the teachers employing the DIA were assigned to four groups according to their development stage. Supporting literature and material related to the teaching skills corresponding to their developmental stage were provided and the area on which each group had to concentrate their efforts for improvement was made clear. Finally, each teacher developed his/her action plan by exchanging ideas with the research team and the members of his/her group.

After the second session, one session per month was scheduled until the end of the school year. This decision provided the teachers with sufficient time to implement the activities included in their action plans and also to reflect on the effectiveness of these activities in order to revise and improve their action plans. The monthly sessions were organised in groups (based on teachers' stages) and teachers were strongly encouraged to cooperate and share ideas and teaching materials, to exchange and discuss their experiences and generally to share the results of their exploration. Teachers' training was based on "active teaching" and the participating teachers had an opportunity to report teaching practices and comment on them, to identify effective and non-effective teaching practices, and to identify the significance of the effectiveness factors corresponding to their developmental stage and how these factors could be linked with effective teaching. Finally, researchers regularly visited teachers at their schools to discuss emerging issues and to provide them with support and feedback.

iii) Sessions for teachers employing the HA

The primary aim of these sessions was to enable individuals to critically evaluate their own beliefs and practice and help them to transform their experiences from a past event to an ongoing learning process. In the second session, teachers had an opportunity to undertake discussion in groups, identify a problem that they considered important in their teaching and formulate a plan of action to tackle this problem. After the second session and the development of the teachers' initial action plans we scheduled one session per month until the end of the school year. This decision provided the teachers with sufficient time to implement the activities included in their action plans and to reflect on the effectiveness of these activities.

The monthly sessions provided the teachers of each stage with an opportunity to revise and further develop their action plans, based on their own and others' experiences. The participating teachers had an opportunity to report their teaching practices and comment on them, and to identify effective and non-effective teaching practices, attitudes and beliefs. For example, the teachers were asked to reflect on what they perceived to be successes and failures in terms of effective teaching and learning. Then they were encouraged to focus on one critical incident (positive or negative) that occurred in their classrooms and to write down their story of experience. They had to describe the incident in detail (e.g., situation, people involved, feelings and reasoning), what they had learned about teaching as a result, how their perspectives had changed and the changes they had made in how they taught as a result. At each monthly meeting we encouraged the teachers within the same group to cooperate and share ideas and teaching materials, and to exchange and discuss their experiences. Finally, as with the teachers employing the DIA, during that period the research team visited the teachers at their schools to discuss emerging issues related to the implementation of their action plans in their everyday teaching.

Phase 4: Final evaluation

By the end of the school year, the teaching skills, teacher perceptions of teaching and student achievement were measured using the same procedure as in Phase 1 of the study. Then a final meeting with all of the teachers took place in order to get feedback about the programme and present the results of the study.

Measures

Student achievement in mathematics

For each year group of students, criterion-reference tests in mathematics were constructed in order to measure their knowledge and skills in mathematics in relation to the objectives of the national curriculum in Cyprus. The tests for different age groups were equated using IRT modelling in order to make the comparison of the test scores meaningful (see Antoniou, 2009).

Student background factors

Information was collected on two student background factors: sex (0=boys, 1=girls), and socioeconomic status (SES). Five SES variables were available: father's and mother's education level, the social status of the father's job, the social status of the mother's job and the economic situation of the family. Following the classification of occupations used by the Ministry of Finance, it was possible to classify parents' occupations into three groups with relatively similar sizes: occupations held by the working class (32%), occupations held by the middle class (39%) and occupations held by the upper-middle class (29%). Standardised values of the above five variables were calculated, resulting in the SES indicator.

Opportunity to learn

Time spent doing homework and time spent on private tuition were seen as measures of the opportunity to learn factor. Private tuition in Cyprus is common and a high percentage of students attend private lessons. Thus students were asked to report the average amount of time spent on homework and on private tuition in mathematics.

Contextual factors at teacher/classroom level

Variables concerned with the context of each classroom, such as the average score at the beginning of the intervention, the average SES score and the percentage of girls, were taken into account. The contextual factors were aggregated from the student level data. We were also able to collect data about three teacher background variables: gender, position (i.e. teacher or deputy head) and teaching experience.

Teacher background characteristics

Information related to teacher gender (male/female), position

(teacher/deputy head) and years of experience was collected. In addition, teachers were asked to indicate their future expectations (to do a postgraduate degree, to be promoted, etc.) and finally to indicate their attitudes towards teaching as a profession on a Likert scale ranging from 1 (most negative) to 7 (most positive).

Teacher perceptions of the characteristics of effective teachers

Teachers were also asked to provide information related to their perceptions of the characteristics of effective teachers. Specifically, the teachers had to indicate on a Likert scale ranging from 1 (least significant) to 5 (most significant) how they perceived the significance of several characteristics, such as being patient, having organisational skills, being able to communicate effectively with children, etc. The reliability of this section was calculated and the value of Cronbach Alpha for each subscale was found to be satisfactory, ranging from 0.75 to 0.84.

Then, in order to examine the construct validity of this part of the questionnaire, a first-order Confirmatory Factor Analysis (CFA) model, designed to test the multidimensionality of a theoretical construct (Byrne, 1998), was used. Specifically, the model hypothesised that: (a) the 4 sub-scale scores could be explained by one factor; (b) each sub-scale would have a nonzero loading on this factor; and (c) measurement errors would be uncorrelated. The findings of the first order factor SEM analysis generally affirmed the theory on which this section of the questionnaire was developed. Specifically, the scaled χ^2 for the one factor structure ($\chi^2 = 2.3$, df =2, p.31) did not reach statistical significance, the RMSEA was .013 and the CFI was .966, all meeting the criteria for an acceptable level of fit. All parameter estimates were statistically significant ($p< .001$). Validation of the first-order factor structure related to this variable provided support for the use of a single score concerned with perceptions of the characteristics of effective teachers.

Teacher attitudes towards tasks that teachers have to perform

A Likert scale was used in which teachers had to indicate the degree to which they like performing several tasks by indicating a number from 1 (least significant) to 5 (most significant). For example, teachers were asked to demonstrate their attitudes towards lesson preparation, dealing with discipline problems, assessing students' performance, etc. In order to examine the construct validity of this part

of the questionnaire, a first-order CFA model was used. Specifically, the model hypothesised that: (a) the six sub-scales scores could be explained by two factors (i.e., Direct effect on learning and Indirect effect on learning); (b) each item (i.e., sub-scale score) would have a nonzero loading on the factor it was designed to measure and zero loadings on the other factor; (c) the two factors would be uncorrelated, and (d) measurement errors would be uncorrelated. The findings of the first order factor SEM analysis generally affirmed the theory upon which this section of the questionnaire was developed. The scaled χ^2 for the two factor structure (χ^2= 7.78, df = 5, p=.17) was not statistically significant, the RMSEA was .073 and the CFI was .972, all meeting the criteria for an acceptable level of fit. Thus a decision was made to consider the two-factor structure as reasonable and the parameter estimates were calculated.

Quality of teaching

Quality of teaching was measured through classroom observations by independent observers both at the beginning (September 2008) and at the end (May 2009) of the intervention. Two low-inference instruments and one high-inference observation instrument were used. The instruments were designed to collect data concerning the teacher factors of the dynamic model, and their construct validity had already been tested using Structural Equation Modelling approaches (see Kyriakides & Creemers, 2008).

Observations were carried out by three members of the research team, all of whom had attended a series of seminars on how to use the three instruments. During the 2008-2009 school year, the external observers visited each class four times. For each scale of the instruments the alpha reliability coefficient was higher than 0.83. Since 26% of the lessons were observed by pairs of observers, the inter-rater reliability coefficient ($\rho 2$) was estimated and was found to be higher than 0.81.

Implementation effort

Since one of the main threats to the internal validity of experimental studies has to do with the extent to which all of the groups put the same effort into implementing the intervention, different sources of data were used to measure this variable. Specifically, we conducted content analysis of the reflective diaries that each teacher kept in order to identify the extent to which the members of each group put effort into implementing their action plans in their teaching. Moreover,

the constant comparative method was used to analyse data emerging from interviews with each teacher participating in this study. These interviews were concerned with the experiences, the attitudes and the amount of time each teacher devoted to the implementation of the intervention. The analysis of the qualitative data from each source of data helped us generate ordinal data measuring the extent to which teachers of each experimental group put effort into implementing their improvement strategies and action plans. The Kolmogorov-Smirnov two sample test did not reveal statistically significant differences between the members of the two experimental groups in terms of their implementation effort (K-S Z= 1.01, p=0.36).

Results

Impact on teaching skills

The observational data of each period were analysed separately following the procedure described by Kyriakides et al. (2009). Specifically, the Rasch model was used in order to identify the extent to which the five dimensions of the eight teacher factors (i.e., the 44 first order factor scores) could be reducible to a common unidimensional scale. The Rasch model does not test only the unidimensionality of the scale but also is able to determine whether the tasks can be ordered according to the degree of their difficulty and whether at the same time the people who carry out these tasks can be ordered according to their performance in the construct under investigation. When the Rasch model was applied to the data of the baseline measure it was found that all of the teaching skills included in the dynamic model were well targeted against the persons' measures, since Rasch person estimates range from -3.06 to 3.12 logits and the estimates of the difficulties of teaching skills ranged from -2.93 to 3.16 logits. Moreover, the reliability of persons (i.e., teachers) and items (i.e., teaching skills) is calculated through the Rasch analysis, indicating how well the scale discriminates among teachers based on their estimated teaching skills and how well the teaching skills can be discriminated from one another on the basis of their difficulty. It was found that the separability of each scale is satisfactory (i.e., higher than 0.93). This implies that the reliability of the scale is very high and furthermore indicates that five levels could be discerned (Bond & Fox, 2001). Finally, the fitting of the Rasch model to the data was tested against alternative item response theory models and was found to be statistically preferable.

Having established the reliability of the scale, it was investigated

whether teaching skills could be grouped into the five stages described in the previous section. The procedure for detecting pattern clustering developed by Marcoulides and Drezner (1999) was used. This procedure enables us to segment the observed measurements into constituent groups (or clusters) so that the members of any one group are similar to one another, according to a selected criterion that stands for difficulty. Applying this method to segment the teaching skills on the basis of the difficulties that emerged from the Rasch model showed that they are optimally clustered into the five clusters proposed by previous research findings. The cumulative D for the five-cluster solution was 58%, whereas the sixth gap adds only 4%.

The above procedure was also employed to analyse data that emerged from the final measurement of teaching skills. The Rasch model revealed that there was no person who did not fit the model, and that all of the teaching skills were well targeted against the persons' measures since persons' scores range from -2.99 to 3.24 logits. It was also found that the difficulties of the teaching skills could be considered invariant across the two measurement periods within the measurement error (i.e., 0.10 logits). Furthermore, the indices of persons and of teaching skills separation were found to be higher than 0.94, indicating that the separability of each scale is satisfactory. Applying the clustering method mentioned above, it was found that the teaching skills could again be optimally clustered into five clusters.

By comparing the classification of teachers into different stages at the beginning and at the end of the intervention, it was found that none of the teachers of the group employing the HA managed to move from one stage to another. On the other hand, 21 of the 65 teachers employing the DIA managed to move to the next stage, whereas the other teachers remained at the same stage. Specifically, 8 teachers of this group moved from stage one to stage two, 8 teachers of stage two managed to move to stage three and 5 teachers of stage three were found to be situated at stage four at the end of the intervention.

In order to measure the impact of the two professional development programmes on teaching skills we also compared the Rasch person estimates. This comparison reveals that the final score of teachers employing the DIA (Mean=0.36, SD=1.05) was higher than their initial score (Mean=-0.28, SD=1.01), and that this difference was statistically significant ($t=4.14$, $df=64$, $p<.001$). On the other hand, the final score of teachers employing the HA (Mean=-0.25, SD=1.04) was not higher than their initial score (Mean=-0.26, SD=1.05) and the t-test for paired

samples did not reveal any statistically significant progress (t=0.87, df=64, p=0.38).

Impact on teacher perceptions and attitudes

At the first stage of the analysis, an independent sample t-test was employed to identify any statistically significant difference between the teachers of the two experimental groups both at the beginning and at the end of the interventions. No statistically significant differences could be identified between the teachers of the two experimental groups at the beginning of the interventions. Similarly, the independent sample t-test was employed to identify statistically significant differences between the teachers of the two experimental groups at the end of the interventions. Again, no statistically significant differences could be identified. Information about the perceptions of each group before and after the innovation is presented in Appendix 1. Finally, the paired-sample t-test revealed that no statistically significant changes in perceptions could be identified either for the teachers who employed the DIA or for those who employed the HA.

Impact on student achievement

The results of the multilevel analysis conducted in order to measure the impact of each of the two approaches to teacher professional development on student achievement are presented in this part. Empty models with all possible combinations of the levels of analysis (i.e., student, teacher and school) were established and the likelihood statistics of each model were compared (Snijders & Bosker, 1999). An empty model consisting of student, teacher and school level represented the best solution. The empty model revealed that 72.3% of the total variance was situated at the student level, 18.5% of the variance was at the classroom level and 10.2% was at the school level. In subsequent steps explanatory variables at different levels were added, starting at the student level. Explanatory variables, except grouping variables, were centred as Z-scores with a mean of 0 and a standard deviation of 1. Grouping variables were entered as dummies with one of the groups as baseline (e.g., girls=0). The models presented in Table 2 were estimated without the variables that did not have a statistically significant effect at level .05.

Table 2. Parameter estimates (and standard errors) for the analysis of student achievement in mathematics (students within classes, within schools)

Factors	**Model 0**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Fixed part (Intercept)	5.19 (0.80)	4.10 (0.78)	3.80 (0.80)	3.70 (0.90)	2.90 (0.80)	2.10 (0.80)	1.90 (0.70)
Student Level							
Context							
Prior achievement in maths		0.80 (.12)	0.79 (.12)	0.81 (.12)	0.80 (.11)	0.80 (.12)	0.80 (.11)
Grade 3		-1.20 (.40)	-1.09 (.40)	-1.08 (.40)	-1.10 (.40)	-1.07 (.40)	-1.07 (.40)
Grade 4		-0.72 (.30)	-0.66 (.30)	-0.62 (.30)	-0.63 (.30)	-0.62 (.30)	-0.62 (.29)
Grade 6		0.65 (.30)	0.64 (.30)	0.64 (.30)	0.65 (.30)	0.66 (.30)	0.64 (.30)
Sex (0=girls, 1=boys)		0.10 (.04)	0.10 (.04)	0.11 (.04)	0.10 (.04)	0.09 (.04)	0.10 (.04)
SES		0.40 (.14)	0.41 (.14)	0.40 (.14)	0.41 (.14)	0.40 (.14)	0.40 (.13)
Cultural Capital		0.19 (.08)	0.19 (.09)	0.20 (.08)	0.18 (.08)	0.18 (.08)	0.18 (.08)
Opportunity to learn							
Homework			0.12 (.04)	0.12 (.04)	0.12 (.04)	0.12 (.04)	0.12 (.04)
Private tuition (0 =no, 1=yes)			N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.
Classroom Level							
Context							
Average achievement in maths		0.40 (.10)	0.40 (.10)	0.40 (.10)	0.40 (.10)	0.40 (.10)	0.40 (.10)
Average SES		N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.
Average cultural capital		N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.
Percentage of girls		N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.
Teacher background							
Gender (0=male, 1=female)				N.S.S.	N.S.S.	N.S.S.	N.S.S.
Years of experience				0.08 (.03)	N.S.S.	N.S.S.	N.S.S.
Position				N.S.S.	N.S.S.	N.S.S.	N.S.S.

Teacher expectations							
Plans for postgraduate degree				N.S.S.	N.S.S.	N.S.S.	N.S.S.
Plans for promotion to head				N.S.S.	N.S.S.	N.S.S.	N.S.S.
Attitudes towards teaching as a profession				N.S.S.	N.S.S.	N.S.S.	N.S.S.
Perceptions of characteristics of effective teachers							
A) Importance of knowledge				N.S.S.	N.S.S.	N.S.S.	N.S.S.
B) Classroom management				N.S.S.	N.S.S.	N.S.S.	N.S.S.
C) Personal traits				N.S.S.	N.S.S.	N.S.S.	N.S.S.
D) Communication skills				N.S.S.	N.S.S.	N.S.S.	N.S.S.
Attitudes towards tasks that teachers have to undertake							
A) Lesson preparation				N.S.S.	N.S.S.	N.S.S.	N.S.S.
B) Teaching				N.S.S.	N.S.S.	N.S.S.	N.S.S.
C) Assessment				N.S.S.	N.S.S.	N.S.S.	N.S.S.
D) Homework assignment				N.S.S.	N.S.S.	N.S.S.	N.S.S.
E) Record keeping and reporting to parents				N.S.S.	N.S.S.	N.S.S.	N.S.S.
F) Administrative work				-0.06 (.02)	-0.05 (.02)	-0.06 (.02)	-0.06 (.02)
Attitudes towards professional development				N.S.S.	N.S.S.	N.S.S.	N.S.S.
Quality of teaching							
Level 1					-0.52 (.09)	-0.51 (.09)	-0.52 (.09)
Level 2					-0.24 (.09)	-0.25 (.09)	-0.25 (.09)
Level 4					0.32 (.10)	0.32 (.10)	0.31 (.10)
Experimental group (0=only reflection, 1=competence based)						0.24 (.08)	0.23 (.08)

Teachers who managed to move to the next stage (0=no movement was observed, 1=move to the next)							0.09 (.03)
School Level							
Context							
Average achievement in maths		0.09 (.04)	0.10 (.04)	0.08 (.04)	0.10 (.04)	0.09 (.04)	0.09 (.03)
Average SES		N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.
Average cultural capital		N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.	N.S.S.
Percentage of girls		N.S.S.	N.S.S,	N.S.S,	N.S.S,	N.S.S,	N.S.S,
Variance components							
School	10.2%	10.0%	9.8%	9.5%	9.1%	8.5%	8.4%
Class	18.5%	17.6%	17.2%	16.0%	11.0%	9.0%	8.6%
Student	72.3%	49.0%	45.0%	44.3%	44.1%	44.0%	44.0%
Explained		23.4%	28.0%	30.2%	35.8%	38.5%	39.0%
Significance test							
χ^2	1213.4	687.3	650.1	590.1	520.0	480.5	460.1
Reduction		526.1	37.2	60.0	70.1	39.5	20.4
Degrees of freedom		9	1	2	2	1	1
p-value		.001	.001	.001	.001	.001	.001

N.S.S. = No statistically significant effect at level .05.

The following observations arise from this table. In model 1 the variables related to the student context were added to the empty model (model 0). This model explained 23.4% of the variance, most of which was attributed at the student level. The χ^2 test revealed a significant change between the baseline model and model 1 ($p<0.001$). Second, all student context variables (i.e., *prior achievement in maths, gender, SES, Cultural capital*) had statistically significant effects on student achievement. Boys were found to have better results than the girls. Nevertheless, *prior knowledge* had the strongest effect in predicting student achievement at the end of the school year. In addition, *prior achievement* is the only contextual variable that had a consistent effect on achievement when aggregated either at the classroom or the school level.

In model 2, the explanatory variables of the student level related to the opportunity to learn were added to model 1. The amount of time

students spent on doing their homework had a statistically significant effect on student achievement. In the third model, all variables related to teacher background factors and teacher perceptions and attitudes were added to model 2. "*Teacher years of experience*" has a statistically significant effect on student achievement, whereas "*teacher positive attitudes towards dealing with administrative work*" has a negative effect on student outcomes. This model explained 30.2% of the variance and the χ^2 test revealed a significant change between model 2 and model 3 ($p<0.001$).

In the next model (i.e., model 4), the variable related to the quality of teaching was added to model 3. Quality of teaching was measured through classroom observations and teachers were assigned to four developmental stages according to their teaching skills. In order to measure the effect of each developmental stage on student outcomes, teachers at stage 3 were treated as a reference group (i.e., stage 3 = 0) and three dummy variables were entered in model 4. The results revealed that the developmental stage at which a teacher is situated has a considerably large and statistically significant effect on student achievement. Specifically, we can observe that the students of teachers at stage 1 have the lowest achievement, whereas students of teachers at level 4 have higher achievement than students of the first three levels. This finding provides support to the developmental nature of the four stages, since students of teachers who were found to belong to higher levels performed better than students of teachers at lower levels. Finally we can observe that model 4 explained 35.8% of the variance while the χ^2 test revealed a significant change between model 3 and model 4 ($p<0.001$), which implies that a teacher's developmental stage is an important predictor of student outcome measures.

In model 5, the effect of each approach employed on teacher professional development was investigated. A dummy variable indicating the approach employed (0 = HA) was entered into the analysis. The DIA was found to have a statistically significant effect on student achievement compared with the HA. Specifically, the effect of this variable is 0.24 (0.08), indicating that the students of teachers employing this approach have better results in their achievement than those whose teachers employed the Holistic Approach. In addition, we can observe that model 5 explained 38.5% of the variance while the χ^2 test revealed a significant change between model 4 and model 5 ($p<0.001$). This provides further support to the argument that the approach used

in teacher professional development programmes is an important predictor of student outcome measures.

Finally, in model 6 the effect of teachers moving to the next developmental stage was investigated. As mentioned in the analysis of the observational data related to the quality of teaching, overall all teachers employing the DIA managed to improve their teaching skills. Moreover, 21 of them made progress to an extent that allowed them to move to the next developmental stage of teaching skills. Thus it was necessary to investigate the impact of this "movement" to the next developmental stage on student academic outcomes. A dummy variable indicating whether teachers managed to move to the next developmental stage was entered in the analysis (0 = no movement observed, 1= moving to the next stage of teaching competences). According to the results in the last column of the above table, moving to the next developmental stage was found to have a statistically significant effect on student achievement.

Discussion

The findings of this study support the hypothesis that teachers can improve and ultimately progress to the next developmental stage of teaching skills, providing they undergo appropriate treatments and participate in effective professional development programmes. As this study has demonstrated, teachers employing the DIA managed to improve their teaching skills, whereas those employing the HA did not manage to do so. In addition, the use of the DIA had a significant impact on student achievement gains in mathematics. A similar observation was made by King and Kitchener (1994), who argued that stage growth is most apparent in teachers who continue their informal education and participate in effective professional development programmes. This is an important reminder that teacher improvement and stage growth does not unilaterally unfold but requires a stimulating and supportive environment.

The issue related to the content of teacher professional development programmes has been addressed in this study by drawing from a validated theoretical model of EER. Specifically, in attempting to describe the complex nature of effectiveness, the dynamic model of educational effectiveness points out not only the importance of specific factors but also searches for grouping of factors. This implies that improvement of teacher effectiveness can be focused neither solely on

the acquisition of isolated skills/competencies (Gilberts & Lignugaris-Kraft, 1997) nor on reflection across the whole process of teaching in order to help teachers to achieve "greater fulfilment as a practitioner of the art" (of teaching) (Clarke & Hollingsworth, 2002, p. 948).

At the same time, the results of this study indicate that reflection is more effective when the improvement priorities of teachers are taken into account and teachers are encouraged to develop action plans that address their professional needs, as has been identified through relevant empirical investigation. Although both experimental treatments encouraged and utilised critical reflection of teachers on their teaching practices, teachers employing the DIA were asked to reflect on those aspects of their teaching practice that were found to be related to their priorities for improvement based on the stage on which they were situated. These stages were defined by taking into account the knowledge-base of EER and especially teacher factors found to be associated with student achievement (Kyriakides et al., 2009).

On the other hand, teachers employing the holistic approach adopted a less focused reflection strategy, which allows teachers to reflect on any aspect of their teaching practice irrespective of the stage on which they were situated. For example, some teachers situated at level 1 employing the holistic approach developed action plans aiming to differentiate their instruction, but their attempts to incorporate differentiation in their teaching were not successful at all. This can be attributed to the fact that they did not possess basic skills corresponding to their stage, such as classroom management and structuring, which could be considered to be a prerequisite for the differentiation of teaching. Thus the holistic approach does not take into account research evidence suggesting that teacher factors and their dimensions can be grouped into stages, structured in a developmental order and associated with student outcomes. This is not to deny in any way that thinking and critical analysis are important, and for this reason these aspects of the holistic approach have been utilised in the development of the DIA. However, complementing reflection with the knowledge-base of EER, which addresses the need for specific groups of teachers, could help us establish more effective approaches to teacher professional development.

The empirical justification of the notion of developmental stages of teaching skills has important policy implications. In particular, policy development could be directed to the establishment of different training courses to address the needs of specific groups of teachers,

according to their developmental stage. The findings of the experimental study provide further support for the fact that improvement of skills and professional development take place gradually. Although the study took place for only one school year, its findings seem to reveal that teachers should master simple but necessary routines such as teaching skills related to the direct teaching approach (i.e., stages 1 and 2) in order to move to the higher stages involving the use of "new learning" approaches and differentiation (i.e., stages 4 and 5). A similar argument has been made by Berliner (1992), who suggests that it is a fallacy to assume that the methods of the experts either can or should be taught directly to beginners. However, all of the stages are of fundamental importance to the professional development of teachers, and educators must be capable of intervening in all stages.

It is important to clarify that in the integrated approach to teacher professional development described in this paper an important aim is to facilitate the process whereby the inner levels of theoretical knowledge of research findings on teacher effectiveness influence the outer levels of teaching practice. In other words, what matters is developing effective teaching behaviour, and to that end it is vital that teachers are not only cognitively aware of the theoretical knowledge related to each factor but that they take the step leading to conscious decisions to make use of this knowledge, and then carry out those decisions effectively. This procedure is significant since many models for reflection are in fact phase models describing the reflection process, and make no pronouncements on the question of what teachers can reflect on. In this sense, the evaluation results, based on the dynamic model, can supplement the process of reflection by helping teachers to determine the skills on which they need to concentrate their efforts for improvement.

Moreover, the findings of this study reveal that teacher perceptions of teaching were not modified for the teachers employing either the DIA or the HA. This finding is in line with many studies that suggest that changing teacher perceptions is hard to achieve (Goodrum, Cousins & Kinnear, 1992; Joyce & Showers, 1980; Sharon, 1987). For example, in research done in the USA by Alger (2009) in a district that offers "a myriad of choices of professional development from workshops on particular strategies to development of small learning communities" (p. 8), it was surprising to note that only one teacher (out of 110) indicated that professional development was responsible for a shift in his or her perceptions of teaching. As research has shown, teacher beliefs about teaching and learning are resistant to change because they

are at the core of a student teacher's world view (Pajares, 1992; Phelan & McLaughlin, 1995). An alternative explanation may be that teacher perceptions may be mitigated by other less tangible context variables in individual schools, such as school size and school climate (Grossman and Stodolsky, 1995). In addition, this might be attributed to the fact that the study took place for one year only. Longitudinal studies are needed to further explore the potential and the characteristics of professional development programmes capable of improving teacher perceptions of teaching.

Nevertheless, despite the fact that teacher perceptions of teaching were not modified in this study, those teachers employing the DIA did manage to improve their teaching skills and their student outcomes. This might imply that improving teacher perceptions and attitudes towards teaching should not necessarily be considered as a prerequisite for improving teacher effectiveness, especially when teachers have volunteered to participate in professional development programmes. This, however, might not be the case when compulsory professional development programmes are imposed on teachers. Further research is needed to clarify this issue.

Finally, suggestions for further research aimed at establishing closer links of EER with teacher professional development are provided. Longitudinal studies may help us to measure both the short term and the long term effect of the DIA. Further studies are also needed in order to test the generalisability of the findings of the study reported here and to expand the proposed theoretical framework. Such studies may reveal that in helping teachers improve their skills other factors such as school policy regarding teaching and school culture should be considered. Such results may not only contribute to the further development of the framework related to the use of the dynamic model for improvement purposes but may also help us establish a theory-driven and evidence-based approach to improving the quality of education.

References

Alger, C. (2009). Secondary teachers' conceptual metaphors of teaching and learning: Changes over the career span. *Teaching and Teacher Education*, 25(5), 743 – 751.

Antoniou, P. (2009). *Using the Dynamic Model of Educational Effectiveness to Improve Teaching Practice: Building an Evaluation Model to Test the Impact of Teacher Professional Development Programs*. Unpublished Doctoral Dissertation, University of Cyprus, Cyprus.

Berliner, D. (1992). Expertise in teaching. In F. Oser, J. – L.Patry & A. Dick (Eds.), *Effective and responsible teaching* (pp. 227-249). San Francisco: Jossey-Bass.

Bond, T., & Fox, C. (2001). *Applying the Rasch Model: Fundamental Measurement in the Human Sciences*. Mahwah NJ: Lawrence Erlbaum Associates. (Available from IOM.).

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.

Byrne, B. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: Basic concepts, applications and programming*. Mahwah, NJ: Erlbaum.

Calderhead, T. (1989). Reflective teaching and teacher education. *Teaching and Teacher Education*, 5(1), 43-51.

Chandler, P., Robinson, W.P., & Noyes, P. (1991). Is a Proactive Student Teacher a Better Student Teacher? *Research in Education*, 45(May), 41-52.

Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education*, 18(8), 947–967.

Cochran-Smyth, M., & Zeichner, K. (2005). *Studying teacher education. The report of the AERA panel on research and teacher education*. USA: American Education Research Association.

Cohen, D.K. (1990). A revolution in one classroom: The case of Mrs. Oublier. *Educational Evaluation and Policy Analysis*, 12(3), 311-329.

Cornford, I. R. (2002). Reflective teaching: empirical research findings and some implications for teacher education. *Journal of Vocational Education and Training*, 54(2), 219-235.

Creemers, B. P. M., & Reezigt, G. J. (1997). School effectiveness and school improvement: Sustaining links. *School Effectiveness and School Improvement*, 8(4), 396 – 429.

Creemers, B. P. M., & Kyriakides, L. (2006). A critical analysis of the current approaches to modelling educational effectiveness: the importance of establishing a dynamic model. *School Effectiveness and School Improvement*, 17(3), 347-366.

Creemers, B. P. M., & Kyriakides, L. (2008). *The Dynamics of Educational Effectiveness: A Contribution to Policy, Practice and Theory in Contemporary Schools*. London: Routledge.

Creemers, B. P. M., Kyriakides, L., & Antoniou, P. (Eds.) (in press). *A Dynamic Approach to Teacher Training and Professional Development*. New York, USA: Springer Publishing.

Day, C. (1999). *Developing Teachers: the challenges of lifelong learning*. London: Falmer Press.

Desimone, M.L., Porter, C.A., Garet, S.M., Yoon, S.K., & Birman, F.B. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis*, 24(2), 81-112.

Elliot, J. (2002, August). Action research as the basis of a new professionalism for teachers in an age of globalisation. Paper presented at a conference to celebrate the centenary year of Beijing Normal University, Beijing, China.

Gilberts, G. H., & Lignugaris-Kraft, B. (1997). Classroom management and instruction competencies for preparing elementary and special education teachers. *Teaching and Teacher Education*, 13(6), 597-610.

Golby, M., & Viant, R., (2007). Means and ends in professional development. *Teacher Development*, 11(2), 237 – 243.

Goodrum, D., Cousins, J., & Kinnear, P. J. (1992). The reluctant primary school teacher. *Research in Science Education*, 22(2), 163-169.

Grossman, P. L., & Stodolsky, S. S. (1995). Content as contest: the role of school subjects in secondary school teaching. *Educational Researcher*, 24(8), 5–11.

Guskey, T. R., & Sparks, D (2004). Linking professional development to improvements in student learning. In E. M. Guyton & J. R. Dangel (Eds.), *Teacher Education Yearbook XII: Research Linking Teacher Preparation and Student Performance*. Dubuque, IA: Kendall/ Hunt.

Hatton, N., & Smith, D. (1995). Reflection in teacher education: Towards definition and implementation. *Teaching and Teacher Education*, 11(1), 33-49.

Joyce, B.R., & Showers, B. (1980). Improving inservice training: The messages of research. *Educational Leadership*, 37(5), 379-385.

King, P. M., & Kitchener, K. S. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.

Kyriakides, L., & Creemers, B. P. M. (2008). Using a multidimensional approach to measure the impact of classroom-level factors upon student achievement: a study testing the validity of the dynamic model. *School Effectiveness and School Improvement*, 19(2), 183–205.

Kyriakides, L., Creemers, B. P. M., & Antoniou, P. (2009). Teacher behaviour and student outcomes: Suggestions for research on teacher training and professional development. *Teaching and Teacher Education*, 25(1), 12-23.

Marcoulides, G. A., & Drezner, Z. (1999). A procedure for detecting pattern clustering in measurement designs. In M. Wilson & G. Engelhard, Jr. (Eds.), *Objective measurement: Theory into practice* (Vol. 5). Westport, Conn.: Ablex Publishing Corporation.

McNamara, D. (1990). Research on Teachers' Thinking: its contribution to educating student teachers to think critically. *Journal of Education for Teaching*, 16(2).

Ministry of Education (1994). *The New Curriculum*. Nicosia: Ministry of Education.

Pajares, M. F. (1992). Teachers' beliefs and educational research: cleaning up a messy concept. *Review of Educational Research*, 62(2), 307–332.

Phelan, A. M., & McLaughlin, H. J. (1995). Educational discourses, the nature of the child, and the practice of new teachers. *Journal of Teacher Education*, 46(3), 165–174.

Reynolds, D., Hopkins, D., & Stoll, L. (1993). Linking school effectiveness knowledge and school improvement practice: Towards a synergy. *School Effectiveness and School Improvement*, 4(1), 37–58.

Schon, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Sharon, D. (1987). The Renfrew Quality Education Project: Teachers' views after the first

year. *Working Papers of the Planning and Development Research Branch*, TV Ontario, 87(2).

Snijders, T., & Bosker, R. (1999). *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. London: Sage.

Stoiber, K. (1991) The Effect of Technical and Reflective Instruction on Pedagogical Reasoning and Problem Solving. *Journal of Teacher Education*, 42(2), 131-139.

Tom, A. (1985). Inquiring into inquiry-oriented teacher education. *Journal of Teacher Education*, 36(5), 35-44.

U. S. Department of Education, National Center for Education Statistics. (1999). *Teacher quality: A report on the preparation and qualifications of public school teachers (NCES 1999-080)*. Washington, DC: Author.

Van Manen, M. (2002). The pathic principle of pedagogical language. *Teaching and Teacher Education*, 18(2), 215–224.

Winitzky, N., & Arends, R. (1991), 'Translating Research into Practice: The Effects of Various Forms of Training and Clinical Experience on Preservice Students' Knowledge, Skill and Reflectiveness'. *Journal of Teacher Education*, 42(1), 52-65.

Wubbels, Th., & Korthagen, F. (1990). The effects of preservice teacher education program for the preparation of reflective teachers. *Journal of Education for Teaching*, 16(1), 29-43.

Zeichner, K.M. (1987). Preparing reflective teachers: An overview of instructional strategies which have been employed in preservice teacher education. *International Journal of Educational Research*, 11(5), 565-575.

Appendix 1. Results of comparing teachers of the two experimental groups based on their initial and final perceptions and attitudes

Variables	INITIAL MEASUREMENT							FINAL MEASUREMENT						
	DIA		HA		Comparison			DIA		HA		Comparison		
	mean	SD	mean	SD	T	d.f.	p	mean	SD	mean	SD	T	d.f.	p
Perceptions of teaching as a profession	2,91	0,9	2,87	0,85	0,24	129	0,81	2,88	0,8	2,87	0,81	0,06	129	0,95
Perceptions of characteristics of effective teachers	13,26	0,86	13,20	0,81	0,37	128	0,71	13,25	0,84	13,21	0,83	0,24	129	0,81
A) Importance of knowledge	4,2	0,55	4,05	0,52	1,16	128	0,24	4,3	0,58	4,12	0,6	1,33	129	0,18
B) Classroom management	4,78	0,33	4,8	0,35	-0,19	129	0,84	4,73	0,35	4,77	0,36	-0,38	129	0,70
C) Personal traits	4,39	0,35	4,4	0,37	-0.09	129	0,92	4,42	0,37	4,38	0,38	0,37	129	0,71
D) Communication skills	4,91	0,33	4,88	0,4	0,28	129	0,77	4,9	0,3	4,89	0,38	0,09	129	0,92
Attitudes towards tasks that teachers have to undertake	12,96	1,72	12,85	1,51	0,49	128	0,62	12,93	1,70	12,84	1,47	0,40	129	0,68
A) Lesson preparation	4,18	0,78	4,22	0,81	-0,25	129	0,80	4,2	0,72	4,21	0,77	-0,06	129	0,95
B) Teaching	3,75	0,80	3,73	0,75	0,12	129	0,90	3,73	0,76	3,75	0,7	-0,13	129	0,89
C) Assessment	3,58	0,84	3,50	0,62	0,53	129	0,59	3,57	0,8	3,53	0,67	0,26	129	0,79
D) Homework assignment	2,96	0,90	2,99	0,93	-0,17	129	0,86	3	0,8	2,98	0,9	0,12	129	0,90
E) Record keeping and reporting to parents	3,12	0,74	3,08	0,78	0,26	129	0.79	3,12	0,8	3,1	0,74	0,12	129	0,90
F) Administrative work	3,42	0,71	3,4	0,72	0,13	128	0,89	3,39	0,65	3,41	0,72	-0,13	129	0,89
Attitudes towards professional development	4,32	0,7	4,37	0,64	-0,34	129	0,73	4,29	0,65	4,34	0,63	-0,35	129	0,72

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Educating Student Teachers to Become High Quality Professionals – A Finnish Case

Hannele Niemi[1]

For decades, the Finnish orientation toward teacher education has committed itself to the development of an inquiry oriented and research-based professional culture. The aims of teacher education are to train students to find and analyse problems they may expect to face in their future work. This study consists of a survey of student teachers (n=545) in two universities in Finland. Web-based surveys with quantitative and qualitative questions were sent to all student teachers in the beginning of May 2010. Students assessed how teacher education had provided them with the competences they need in a high standard profession, what kinds of active learning experiences they had in their TE studies, and how research studies of teacher education had contributed to their professional development. The participants of the study assessed that they had achieved good skills in planning teaching and curricula. They were capable of using different teaching methods. They were aware of their own teaching philosophy and their responsibilities as professionals and life-long learners. They consider the research component of TE valuable to their independent and critical thinking. They were very engaged in studies. Finnish pre-service teacher education seems to function very well and to be effective in providing the skills teachers need to work as independent professionals. The results of the study show, however, that students also need more supervision and guidance on how to collaborate with parents and other stakeholders outside school, such as representatives of working life as well as partners in business life and culture.

Keywords: Active learning, Professional development, Student teachers, Teacher education, Teachers

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Introduction

Finnish teacher education has received a great deal of attention because of the high learning outcomes of Finnish 15-year-old students in Pisa achievement testing. Finland was in the highest position or among the three best countries in 2000, 2003, 2006 and 2009 (OECD). Many researchers, as well as Finnish policy makers, regard high quality teachers and teacher education as one of the major factors in good learning outcomes.

During the last twenty years, Finnish teacher education has been evaluated systematically in many national and international evaluations. Many research projects and doctoral dissertations on some components of teacher education have also provided important knowledge for further development (e.g., Buchberger et al., 1994; The Committee Report, 1994; Finnish Higher Education Evaluation Council, 2011; Jussila & Saari, 1999; Ministry of Education, 2007; Niemi, 1996; Niemi, 1999; Niemi & Kemmis, 1999; Niemi & Kohonen, 1995).

Some of the evaluations have focused on structural and higher education policy issues, while some have concentrated on themes of teachers' professional development in teacher education. The present study belongs to the latter evaluations.

This study aims to investigate how student teachers in two universities assess their experiences and learning outcomes in teacher education.

Because there are both structural and content-based differences between elementary and secondary teacher education, one of the aims of the study is to investigate what the major differences between assessments of primary and secondary school student teachers in professional competences and skills are.

According to decrees issued in 1979 and 1995, all prospective teachers in Finland have to attain a master's degree as a teacher qualification. In terms of the Bologna process, the qualified teachers' degree is equivalent to the second cycle degree in the European higher education area (Niemi & Jakku-Sihvonen, 2006). In the Finnish educational system, the combination of a three-year bachelor's degree and a two-year master's degree in appropriate subjects qualifies teachers to teach subjects in primary and secondary schools or general subjects in vocational institutions. This means that all other teachers must attain a master's degree (BA 180 European credits (ECTS) + MA 120 = 300 ECTS; 1 ECTS is about 27 hours' work).

Primary teachers, also called class teachers, have educational science as their major, and this degree requires the completion of a master's thesis. The topics of the theses can be highly school-related, and the theses are very often action research projects. Secondary school teachers, also called subject teachers, complete a major in their academic teaching subject and a substantial minor in pedagogy. Teacher education in universities does not follow any strictly defined programmes. Students have opportunities to create their own study plan selecting those modules required for teacher qualifications for different levels of the educational system. Nonetheless, teacher education departments offer certain study schedules in order to make studies effective and efficient.

Finland does not have any common national standards for teacher education. Each university is responsible for the quality of the programmes and studies they provide. The Teacher Education Act and relevant decrees provide frameworks and common guidelines; however, universities are free to modify their own courses and programmes. Even though there are no national standards there are many unofficial common principles and recommendations on which national TE working groups and Deans of TE educational departments have agreed. The following main structural guidelines were accepted in 2006:

The main elements of all teacher education curricula consist of studies in:

- **Academic disciplines**. These can be whichever disciplines are taught in schools or educational institutions or in the science of education. Academic studies can be a major or minors depending on the qualification being sought. Class teachers have a major in educational sciences and minors in other disciplines.
- **Research studies** consist of methodological studies, a BA thesis and a MA thesis.
- **Pedagogical studies** (min. 60 ECTS) are obligatory for all teachers. They also include teaching practice.
- **Communication, language and ICT studies** are obligatory.
- The preparation of **a personal study plan** is a new element in university studies in Finland. Its main function is to guide students to develop their own effective programmes and career plans, and to tutor them in achieving their goals.

- **Optional studies** may cover a variety of different courses through which students seek to profile their studies and qualifications.

Pedagogical studies

The traditional distinction between class teachers and subject teachers has been retained, but the structures of the respective degree programmes allow students to take very flexible routes, to include both in the same programme or permit later qualification in either direction. Pedagogical studies (60 ECTS) are obligatory for qualification as a teacher and are approximately the same for both primary and secondary teachers. These studies give a formal pedagogical qualification to teachers of all levels in the Finnish educational system regardless of the programmes in which they are provided. They provide teachers' general competences with an emphasis on a reflective and research-based orientation in the teaching profession. According to the law, pedagogical studies must be studies in the science of education. Pedagogical studies can be part of degree studies or they can be taken separately after the completion of a master's degree.

The goal of pedagogical studies is to create opportunities to learn pedagogical interaction, to learn how to develop one's own teaching skills, and how to plan, teach and evaluate teaching in terms of the curriculum, the school community, and the age and learning capacity of the pupils. Students should also learn how to cooperate with other teachers, parents and other stakeholders and representatives of the welfare society. (www.helsinki.fi/vokke)

Teachers' pedagogical studies also include guided teaching practice (approx. 20 ECTS). The aim of guided practical studies is to support students in their efforts to acquire professional skills in researching, developing and evaluating teaching and learning processes. In addition, students should be able to reflect critically on their own practices and social skills in teaching and learning situations. During guided practical studies, students should meet pupils and students from various different social backgrounds and learning orientations and have opportunities to teach them according to the curriculum.

An important aim of pedagogically oriented studies is also to educate teachers who are able to study and develop their own researched-based practices. For this reason, the modules on behavioural research methods are also obligatory for subject teachers.

Perspective and theoretical framework

For decades, the Finnish orientation toward teacher education has committed itself to the development of a research-based professional culture (Niemi & Jakku-Sihvonen, 2006). The aim of TE studies is to train students to find and analyse problems they may expect to face in their future work.

Professional skills

The measurements of professional skills are based on the paradigms of the reflective teacher, the teacher as a researcher, and inquiry-oriented teacher education (e.g., Darling-Hammond, 2005, 2010; Niemi, 2002; Scardamalia, 2000; Smyth, 1995; Tabachnick & Zeichner, 1991). The theoretical framework of professional skills also consists of a concept that takes a broad view of teachers' professional role in schools and society.

There are tensions in many countries on how the practical component of teacher education, e.g., teaching practice, should be integrated and implemented in teacher education programmes. As professionals, teachers need many practical skills that enable them to mediate academic subject knowledge, values and attitudes to individuals or groups. Teachers need the confidence to work with learners in real situations, and student teachers often ask for very practical advice on their teaching practice. Recent research on expertise has revealed that there are different phases in the development of individual expertise (Dreyfus & Dreyfus, 1986). Student teachers also need different kinds of support in the different phases of their development.

In Finnish teacher education the aim is for teachers to be able to work as independent professionals in schools and to make an active contribution to educational issues including the development of school curricula, as well as formative and summative assessments of students' learning. These competences require strong expertise and the integration of different kinds of knowledge. Davenport and Prusak (1998) have found that an expert needs codified knowledge and organised official and literally transferable knowledge. In addition, the development of expertise requires role models, observing experts, tacit knowledge, a social network and even good stories of successful practice. Davenport and Prusak (1998) point out that experts' knowledge is deep personal knowledge that has been tested in practical situations.

According to Schön (1991), experts always face problems in

situations that are unique and consist of uncertainties, value conflicts and other tensions because of complexity. They work in complex situations. This establishes special requirements for their knowledge base. Experts' knowledge is rational in nature, but this is not sufficient. They also need principles, rules and models, and they need to know how to apply scientific theories and techniques to complex problems.

Working as an expert means that one has the knowledge and practical abilities to work in complex situations. In addition, experts need confidence in two complementary ways (Isopahkala-Brunet, 2004): they need the self-confidence to carry out their expertise in demanding unique situations, and they also need to implement their expertise in such a way that their customers, stakeholders and colleagues trust them. In the teaching profession this means that students and parents, and even society at large, need to be able to trust teachers' expertise.

Although teachers need many specific skills they also need a comprehensive idea or vision of what their work as an educational expert means. Teachers need to understand the complexity of educational processes and see evidence that comes from different sources. They need research-based and research-informed knowledge, but they also need to be open to acquiring and assessing local evidence. Scardamalia and Bereiter (2003) have examined the behaviour of experts. The feature that really distinguishes experts from others is their approach to new problems. The pattern recognition and learned procedures that lead to intuitive problem solving are only the beginning. The expert invests in what Bereiter and Scardamalia call progressive problem solving, that is, tackling problems. Unlike reducing problems to previously learned routines, this increases expertise.

Active learning

How to get students to become more active learners is a very common problem in many countries. Active Learning research has revealed that teachers who seek to tutor their pupils to become active learners gain a new pedagogical role. They become facilitators who give more responsibility to students. They are more democratic; they negotiate more with students about aims, methods and control of learning. They see, more than before, all learners as resources for one another. New teaching methods, which consists of more independent learning, more collaborative arrangements, more open tasks and projects, enables students to collaborate with one another, but very often a teacher

is also a partner in a learning team. A teacher's position is no longer at the front of the classroom, nor in the centre of the classroom, but s/he is a circulating expert, learning together with students and trying to give as much space as possible to his/her students. To promote active learning, the teacher should be a tutor. In addition to the teacher, other partners (e.g., peers, parents, employers) in networks and co-operative projects should have a tutoring and supporting role. These scenarios of teachers' work create new demands on teacher education.

Hannele Niemi has investigated active learning in schools and teacher education (e.g., Niemi, 2002). The research focused on the Finnish case of active learning in teacher education and found that there are many factors that are obstacles to active learning. Schools, as well as teacher education institutions, change very slowly. We carry our learning culture from the early days of our own school life, and it forms our concepts and ideals as to what we regard as the aims of learning.

The framework of active learning assessment in this study is based on theories that consider learning as a constructivist and collaborative process. Active learning consists of independent inquiry, the structuring and restructuring of knowledge, a problem solving orientation, a critical approach and the evaluation of knowledge. The goals of learning are that the learner can elaborate on applications of knowledge and s/he is capable of producing new knowledge individually and collaboratively (e.g., Nonaka & Toyama, 2003; Scardamalia, 2002; Sfard, 1998). Active learners develop their skills of inquiry and learn to reflect on and control their own learning processes (e.g., Pintrich & McKeachie, 2003). Knowledge is not just an individual possession but is socially shared and emerges from participation in sociocultural activities. Learning is increasingly seen as building knowledge together. When seeking new ways for knowledge creation as an interactive process we see that all educational settings, including schools, should prepare students for 'virtuous knowledge sharing' (European University Association, 2007, p. 21).

Research studies in teacher education

An important aim of research oriented studies is also to educate teachers who are able to study and develop their own research-based practices. For this reason, modules on behavioural research methods are also obligatory for all TE students in Finland. The critical scientific literacy of teachers and their ability to use research methods are considered crucial. The goal of these studies is to train students to find and

analyse problems that they may expect to face in their future work. Research studies provide students with an opportunity to complete an authentic project in which students must formulate a problem in an educational field, be able to search independently for information and data related to the problem, elaborate on them in the context of recent research in the area and synthesise the results in the form of a written thesis. They learn to study actively and to internalise the behaviour of how teachers may act like researchers in their work.

The research component is an essential part of Finnish teacher education. It comprises approximately 20% of the entire TE studies of both elementary teachers (major in Education) and secondary school teachers (major in Academic Subject). Despite initial difficulties in integrating research studies with other components of TE in the 1980s, research methods and the writing of a master's thesis are now among the best segments of elementary school teacher education (e.g., Niemi 2002; Niemi & Kohonen 1995;). The general result of evaluations is that the more demanding the studies are, in terms of quality of learning, the more useful they are.

The research

In this research we investigate:

- How well do teacher education studies provide wide and comprehensive professional competences to student teachers?
- How do teacher education studies steer student teachers to become active learners?
- What kind of contribution does a research component in teacher education bring to student teachers' professional development?

Data collection

The study consists of a survey to student teachers with the following measures:

- Teachers' professional skills and competences needed in a high standard profession (40 questions)
- Student teachers' experience of active and collaborative learning in TE (20 questions) and 5 open-ended questions.
- Student teachers' experiences of the research component in teacher education and how research studies of teacher education had contributed to their professional development (20 questions).

Most of the questions were structured items using a 1-5 scale. There were also open answers for qualitative descriptions of their experiences during TE. The questionnaires were based on the theoretical basis presented in the earlier chapter, on the guidelines and aims of the Act and Decrees of Finnish teacher education, as well as on national strategies, e.g., the use of ICT in schools.

The questionnaires on professional skills and competences and active learning had many of the same questions that had appeared in earlier surveys of Finnish teacher education (Niemi, 1995).

The open-ended questions were:

- Describe 1–3 learning situations or units in your university studies in which you experienced being a strongly active learner.
- What are the greatest obstacles to active learning in teacher education?
- How could teacher education give teachers the readiness to tutor pupils at schools for active and self-regulated learning?

Analysis methods of the study were quantitative and qualitative. The quantitative data has been analysed using descriptive statistics: means and standard deviations. In addition, correlate and multivariate methods were applied. Data reduction methods, such as Factor Analysis, were used (Principal axel method with Varimax and Promax rotations) in the analysis of the Active Learning questionnaire. The qualitative data has been analysed using content analysis techniques. The categories that describe student teachers' best active learning experiences will be presented in this study.

Sample

The data of this study were collected among students of class teacher and subject teacher education programmes at the Universities of Helsinki and Oulu. These two universities offer both primary and secondary teacher education degrees, with the main structures of TE being the same in both universities. In terms of contextual differences between universities, we can find some special features. The University of Oulu is a more technology oriented university and has many regional responsibilities to the locality. The University of Helsinki is an internationally recognised comprehensive university with an emphasis

on basic research. Both universities have been actively involved in national cooperation to develop teacher education and follow joint agreed recommendations. Therefore, there is no hypothesis that these two universities would differ in assessments made by their student teachers. Both universities have a strong research oriented component in pedagogical studies as well as in subject matter studies. All students have to write both BA and MA theses in their major subject. Class teachers major in educational sciences whilst subject teachers major in academic subjects with a substantial minor in Education. Teaching practice is integrated with pedagogical studies from the beginning of the studies. (Jakku-Sihvonen & Niemi, 2006).

Web-based surveys were sent to all student teachers in the beginning of May 2010 and the website was open until 4 June 2010. Departmental mailing lists were used in data gathering. The students could assess their TE studies anonymously. Two email reminders about the questionnaire were sent to the mailing lists. The official, total number of student teachers in both universities is approximately 1450, consisting of 1000 class teachers (all students in 5 years programmes) and 450 subject teachers undertaking one year pedagogical studies. The exact numbers of students are very difficult to estimate because students have a lot of freedom to make their personal study plans, which can shorten or lengthen their study times. A total of 605 students visited the web-based interview sites, but the number of students who actually responded varies between sets of questionnaires and open ended questions. Around 30-42% of the total number of different student teachers' groups responded to the questionnaires. In comparison to general answer rates in web surveys we can view the achieved rate as good, or at least satisfactory. The background information about the respondents is outlined in Table 1. The total number of students in the survey is between 545-331, depending on the questionnaire.

Table 1. Students in the web-based survey. The average time taken to answer the study was 51 minutes, median 24 minutes.

	f (%)		f (%)		f (%)	f (%)	f (%)
University	University of Oulu 223 (40.2%)		University of Helsinki 332 (59.8 %)				
Gender	91 Males (16%)		464 Females (83,6%)				
Programme	313 class teacher students (56.4%)		236 subject teacher students (42.5%)				
Age	<25 years 268 (48.3%)	25-43 235 (42.3%)	35-44 39 (7%)	45-55 13 (2.3%)			
Phase of studies	1 year 187 (33.7%)	2 years 128 (23.1%)	3 years 74 (13.3%)	4 years 69 (12.4.%)	5 years 55 (9.9%)	6 years 22 (4%)	>6years *n* = 20; (3.6%)
Representatives of different school subjects	Maths and Science 212 (21.8%)	Foreign languages 81 (14.6%)	Mother tongue 61 (11%)	History and Social sciences 32 (5.8%)	Religion and Ethics 33 (5.9%)	All other major options 112 (20.2%)	

Results

Professional skills and competences

The highest professional competences (Table 2) have been achieved in the following skills: (1) Designing of instruction, (2) Critical reflection on one's own work, (3) Becoming aware of the ethical basis of the teaching profession, (4) Life-long professional growth, (5) Self-evaluation of one's own teaching, (6) Using teaching methods, and (7) Development of one's own educational philosophy. All of these have a mean value of at least 3.5 and standard deviation is less than 1.00. These are all high level professional skills necessary for experts who develop their own work. Very close to these skills are the following competences: Mastering academic contents of curriculum, Independent management of teachers' tasks, Commitment to teaching profession, Researching one's own work, Education of a student's whole personality, Critical assessment of teacher education, and Confronting multiculturalism. All of these have a mean value of at least 3.00.

The weakest skills student teachers have achieved are in administrative tasks and management of tasks outside a classroom (keeping an eye on students during recess, school festivals, trips, morning assemblies, etc.). Cooperation with parents, representatives of work life and cultural partners is also weak, as is working in cooperative action research projects, student welfare groups and other school community groups. Acting in conflict situations (as mobbing) was also a weak competence. All of these competences have a mean value under 2.5. A common feature of all of these skills is some kind of cooperation with partners outside the school community or tasks outside classrooms.

Table 2. How well has the teacher education you have participated in so far provided you with a readiness for the teaching profession? (1 = very weakly, 2 = weakly, 3 = fairly, 4 = well, 5 =very well). The skills are set in a ranking order. (*** = < p 0. 001; ** = p <0.01; * = p< 0.05)

Professional competence	M (n=455)	SD	Differences between years in TE df = 5, 449	Differences between class and subject teachers df = 1, 454	Correlation with active learning n = 317-345
1. Designing of instruction	3.92	.856		F=6.95 ***	.14 **
2. Critical reflection on own work	3.76	.894	F=3.07 **		.37 ***
3. Becoming aware of ethical basis of teaching profession	3.71	.914			.21 **
4. Life-long professional growth	3.69	.896	F=3.29 ***		.23 **
5. Self-evaluating of own teaching	3.67	.934	F=4.18 ***		.25 ***
6. Using teaching methods	3.54	.764			.32 ***
7. Development of own educational philosophy	3.46	.977	F=3.13 **	F=9.84 ***	.29 ***
8. Mastering academic contents of curriculum	3.44	.926			.11 *
9. Independent management of teachers' tasks	3.39	.926		F=6.66 ***	.17 **

10. Commitment to teaching profession	3.39	.948			.24 ***
11. Research of own work	3.29	1.031	F=2.13 *		.26 ***
12. Education of a student's whole personality	3.23	.943	F=3.34 **	F=10.91 ***	.29 ***
13. Critical assessment of teacher education	3.23	1.153			.37 ***
14. Confronting multiculturalism	3.16	.985		F=6.80 ***	.11 *
15. Confronting changing circumstances of a school	3.07	.914		F=3.99 ***	.34 ***
16. Supporting a learner's individual growth	3.07	.917		F= 2.32 *	.32 ***
17. Management of classroom interaction	3.03	.926		F=2.13 *	.19 **
18. Self-regulated learning	3.01	.922		F=3.67**	.39 ***
19. Differentiating of teaching	3.00	.903	F=1.84 *	F=13.38 ***	.15 **
20. Intercultural education	3.00	1.001	F =2.13 *		.24 ***
21. Developing applications of modern information technology	2.98	.956	F=2.21 *		.34 ***
22. Preparing students for a future society	2.95	.941			.32 ***
23. Promoting equity of sexes	2.95	1.054			.28 ***
24. Developing of school curriculum	2.94	.968	F=2.78 **	F=7.26 ***	.30 ***
25. Evaluating and grading of students	2.93	.927		F=231 *	.19 **
26. Revising students' learning environments	2.90	.934	F=2.30 **	F=7.92 ***	.40 ***
27. Readiness for media education	2.89	.906			.31 ***
28. Providing readiness for students for daily life	2.88	.897			.28 ***

29. Working as a change agent in a society	2.81	1.023		F=4.78 ***	.40 ***
30. Evaluating students' learning capacity	2.77	.852			.24 ***
31. Doctoral studies after MA in education	2.63	1.024	F=2.30 **		.26 ***
32. Cooperation with representative of cultural life	2.42	.976	F=2.9 **	F=4.96 ***	.22 **
33. Acting in conflict situations (as mobbing)	2.37	.935			.23 **
34. Working in a school community (teaching staff and other school personnel)	2.28	.922		F=2.48 *	.11 **
35. Working with a student welfare group	2.28	.877			.22 ***
36. Cooperative action research	2.28	1.008	F=2.90 **	F=7.55 ***	.32 ***
37. Cooperation with parents	2.26	.898			.14 *
38. Cooperation with representatives of work life	1.85	.792	F=2.30 **	F=3.78 **	.29 ***
39. Management of tasks outside the classroom (keeping on eye on students during recess, school festivals, trips) morning assemblies, etc.)	1.79	.813		F=685 ***	.28 ***
40. Administrative tasks (information letters, reports, student transfers to other groups or schools) diaries)	1.67	.771		F=3.56 **	.04

Student teachers from different study phases were involved in the survey. When comparing differences using one-way ANOVA there were significant differences in 15 skills according to the number of years the students had participated in TE (Table 2): more years meant more competences. Professional competence areas such as Critical reflection on one' own work (F=3.07 **), Life-long professional growth (F=3.29

***), Self-evaluating of one's own teaching (F=4.18 ***), and Development of one's own educational philosophy (F=3.13 **) need more time and are better achieved in later years of study. Many practical skills, e.g., Using teaching methods and mastering academic contents of the curriculum, and even Independent management of teachers' tasks, do not have effects caused by the number of years of study. There are neither significant differences caused by the number years of study in the following professional competences: Becoming aware of the ethical basis of the teaching profession and Commitment to the teaching profession. These qualities provide evidence that teacher education has succeeded in laying sustainable grounds for student teachers' development from the first years of teacher education.

Differences between class teachers and subject teachers

When comparing differences between class teachers and subject teachers using one-way ANOVA there were significant differences in 20 skills (Table 2). Subject teachers who teach mainly in lower and upper secondary schools (grade levels 7-12) have much fewer pedagogical competences than class teachers. There are very strong differences in the following competences: Education of a student's whole personality (F=10.91 ***), Confronting multiculturalism (F=6.80 ***), Differentiating of teaching (F=13.38 ***), Designing of instruction (F=6.95 ***), Developing of school curriculum (F=7.26 ***), Revising students' learning environments (F=7.92 ***), and Development of one's own educational philosophy (F=9.84 ***). As above, there are no significant differences in the professional competences of Becoming aware of the ethical basis of the teaching profession and Commitment to the teaching profession. Even though there are also positive results in many fundamental basic skills of secondary student teachers, they differ in 20 skills when compared to class teachers. The result highlights an urgent necessity to develop secondary school teacher education in many areas of teachers' professional competences.

Active learning

The students assessed that they had the following active learning experience the most often (Table 3): they worked intensively on their assignments, applied knowledge, and tried to understand matters and phenomena even though it required extra time. They were tutored if needed, but otherwise they worked independently or in peer

groups. They discussed the best solution for the assignments together and self-evaluated their own products. They also sought a great deal of additional knowledge. They had these experiences almost every week.

Almost the same questionnaire (18 of the same questions) was used in a Finnish study of student teachers at three universities in 1995 (Niemi, 2002). We can see that in 15 years there has been a big shift towards more active learning in teacher education. In the mid 1990s, active learning methods were used once or twice a year and web environments almost never. Now, in 2010, students have active learning methods every month or every week. The scale was the same. In the earlier surveys there were only 5 active learning methods that were used about once in a month: Students worked intensively on their assignments (M=3.54), Students were tutored if needed, but otherwise they worked independently or in peer groups (M=3.12), Students discussed the best solution for the assignments together (M=3.08), Students self-evaluated their own products (M=3.23), Students set objectives for themselves and their learning (M=3.37), and Students worked in groups on problem-solving tasks (M=3.26). In 2010, almost all active learning methods were used at least once a month or weekly.

Table 3. Active learning in teacher education. 1 = almost never, 2 = once or twice a year, 3 = about once a month, 4 = about once a week, 5 = nearly daily.

Active Learning methods	M	SD
1. We work intensively on our assignments.	3.72	.95
2. We have to apply knowledge.	3.60	1.12
3. We try to understand matters and phenomena even though it takes time.	3.49	1.09
4. We are tutored if needed, but otherwise we work independently or in peer groups.	3.48	1.05
5. We discuss the best solution for the assignments together. (+)	3.44	1.10
6. We self-evaluate our own products.	3.43	1.06
7. We seek a lot of additional knowledge.	3.43	1.12
8. We set objectives for ourselves and our learning.	3.41	1.05
9. We know how to develop our own learning.	3.35	1.11
10. We work in groups on problem-solving tasks. (+)	3.25	1.12
11. We independently produce, e.g., reviews, outlines of sessions, and presentations	3.24	.92

12. We have to seek almost all knowledge independently from different information sources.	3.20	1.15
13. We use and apply knowledge very critically.	3.19	1.26
14. We experiment and elaborate on new solutions to roblems.	3.08	1.09
15. We independently plan and carry out learning contracts for which we are responsible.	3.02	.98
16. We use electronic databases and social media to seek knowledge for our assignments.	2.94	1.24
17. We seek knowledge off campus.	2.92	1.12
18. We have to elaborate on our assignments independently or in peer groups only based on a general theme.	2.63	1.05
19. We have to take responsibility for planning and carrying out fairly large projects.	2.40	.99
20. We plan together the content and working methods of study unit.	2.39	1.30

The active learning scale was analysed using correlations and factor analysis with Varimax and Promax (oblique) rotations. Correlations of all active learning items were significant (most over .30). It would have been possible to extract two dimensions of active learning: (1) Independent knowledge inquiry and creation individually and in groups and (2) Critical approach to knowledge and one's own learning. However, these factors correlated very highly (>.70) and therefore only one combined variable was constructed containing all 20 items (alpha= .93). This variable is used when searching for relationships between active learning and professional competence.

Active learning is related to professional competences in a very interesting way (Table 2). The strongest relationships exist between active learning and professional competences in tasks that require a strong reflective orientation and commitment to the teaching profession. Active learning has the strongest correlations (.37 -.40) with the variables (27) Revising students' learning environments, (25) Working as a change agent in a society, (34) Self-regulated learning, (35) Critical reflection on one's own work, and (24) Critical assessment of teacher education.

Students were asked to describe their best experiences in active learning. The writings of 253 students were analysed using content analysis techniques. Six main categories could be found. These are not separate but integrated with each other in many ways. The categories are:

- **Collaborative working culture**, active discussions with peers and professor/supervisors, knowledge sharing in coursework,

examinations where a group is responsible for outcomes. (92 notes, 36 % from 253)

- **Teaching practice**, to apply knowledge to teaching and learning, requiring one's own engagement and commitment. This category also consisted of many notes about encouraging feedback from supervisors. The important features in teaching practice were opportunities to experiment and to work with pupils in schools. Many descriptions also consisted of an idea about collaboration with student teachers, supervisors and teachers responsible for theoretical studies of pedagogy. (76 notes, 30% from 253)
- **Opportunity to own applications**, freedom to make one's own plans, design or develop large units for one's own or pupils' learning. (48 notes, 19% from 253)
- **Research studies** including writing BA and MA thesis, commitment to inquiry, learning a critical approach to knowledge. (35 notes, 13 % from 253)
- **The large course units** or programmes that had been implemented throughout with active learning methods focusing on understanding phenomena in life and connections between different disciplines in a new and deeper way. (14 notes, 6 % from 253)
- **Subject matter projects or subject matter pedagogy** related to different school subjects (39 notes, 15 % from 253), requiring independent inquiry or collaborative knowledge creation.

The students surveyed had a lot of active learning experience. The study provides evidence that there is a relationship between active learning and high level professional competences: the more active learning, the higher the professional skills and vice versa. The best active learning experiences emerge in collaborative work and study culture. Teaching practice is a very important forum for active learning. Students also appreciate the freedom to experiment and design their own learning paths.

Research studies in teacher education

Student teachers were asked to assess how research studies had contributed to their professional development. The most important abilities they had learnt through research studies were: Critical thinking, Independent thinking, Inquiring, Scientific literacy and

Questioning phenomena and knowledge. The general picture is very positive. Almost all of the variables have a mean >.3.00. Student teachers see research studies as valuable for the teaching profession and see their future work in this as a continuous developmental task.

Table 4 Research studies in student teachers professional development.
1= very little, 2= little, 3= somewhat, 4= much 5= very much (N= 328-338, from which 51 students answered 0 = I have not yet had research studies - these students have been subtracted)

How research studies, including research methodological studies and BA/MA theses, have promoted teachers' professional development	**M (N=277-288)**	**SD**
Development of readiness for inquiry	3.82	.91
Development of independent thinking	3.72	.90
Understanding research literature	3.67	.95
Questioning knowledge and phenomena	3.55	.95
Development of critical thinking	3.55	1.01
Development of methods for knowledge creation	3.45	1.02
Considering teaching profession of as continuous developmental task	3.43	1.12
Conscientiousness of error sources of research	3.37	1.03
Considering working as a teacher as continuous growth	3.27	1.18
Understanding significance of research in classrooms and schools	3.23	1.11
Becoming conscious of societal significance of teaching profession	3.19	1.14
Development of my own personality	3.13	1.16
Applying research knowledge to practice	3.14	1.08
Increasing societal consciousness	3.14	1.07
Increasing responsibility in teaching profession	3.11	1.17
Understanding students' learning processes	3.09	1.17
Increasing a teacher's ethical responsibility	3.00	1.16
Research-based development of schools	2.93	1.08
Clarification of significance of a teacher's work	2.89	1.11
Development of educational responsibility	2.88	1.12

Students had an opportunity to give their additional comments: What else would you like to say about research studies? Their

comments were analysed with content analysis.

Amongst class teachers (n = 88) comments in the following categories could be found: 1) Very important and useful for teaching profession (25 comments), 2) Too many research studies, they took time from other studies (22 comments), 3) Supervision was weak (14 comments), 4) Weak quality of studies and problems in organising and scheduling them with other studies (14 comments), and 5) Too separate from practice (9 comments).

Secondary school teachers (n = 50) did not criticise the quantity of studies and there were only 6 comments suggesting that research studies are too separate from practice. Instead, there were many (16) critical comments on the quality of studies and how they were organised. Some students felt that research studies in pedagogy had been very superficial. The major problem was that there was a lack of cooperation between their subject matter faculty and the pedagogical faculty. This overloaded students and caused a lot of problems. There were also positive comments (12) in which students emphasised the importance of these studies for the teaching profession.

Summary and conclusions

Finnish teacher education has a long history in educating high standard professionals. Typical features have been commitment to a research-based orientation and promoting teachers' work for contexts that require autonomous expertise. The present research provides important information about the strengths and weaknesses of current Finnish teacher education. Finnish student teachers are committed to the teaching profession and are aware of the ethical grounds of teaching. Student teachers assess that they have high competences for their profession. They have good skills in planning teaching and using different teaching methods. They are aware of their own teaching philosophy and their professional responsibilities. They consider the research component of TE as valuable for their independent and critical thinking. They are very engaged in studies. More training for cooperation with parents, representatives of work life and cultural partners is also needed in teacher education, as well as for the preparation of teachers to act in conflict situations (such as mobbing). A common feature of all of these skills is cooperation with partners outside the school community or tasks outside classrooms.

Students have a lot of active learning experiences. The study

provides evidence that there is a strong relationship between active learning and high level professional competences: the more active learning, the higher professional skills and vice versa. The best active learning experiences emerge in collaborative working and study culture. Students appreciate having the freedom to experiment and design their own applications of active learning.

The research component in teacher education is important to the majority of students, but there are also student teachers who are critical of these studies. Most critical voices are related to the quality of the studies or to practical arrangements (e.g., timing) and there is also a need to develop research studies in such a way that students can see their relevance to teachers' professional work.

Finnish pre-service teacher education seems to function very well and to be effective in training professionals. Finnish teacher education has been assessed several times and its development is based on these reviews. The present study provides new information for further development. This study also provides scenarios and evidence regarding what research based-teacher education is and how to develop teacher education by implementing the following principles:

- Teachers need a profound knowledge of the most recent advances in research in the subjects they teach. In addition, they need to be familiar with the latest research on how something can be taught and learnt.
- Teacher education in itself should also be an object of study and research. This research should provide knowledge about the effectiveness and quality of teacher education.
- The aim is for teachers to internalise a research-orientated attitude towards their work. This means that teachers learn to take an analytical and open-minded approach to their work and that they develop their teaching and learning environments in a systematic way.

References

European University Association (2007). *Creativity in Higher Education. Report on the EUA Creativity Project 2006-2007*. Brussels: European University Association.

Buchberger, F., De Corte, E., Groombridge, B., & Kennedy, M. (1994). *Educational studies and teacher education in Finnish universities. A commentary by an international review team*. Helsinki: Ministry of Education, Division of educational and research policy, 14.

The Committee Report (1994). *Educational sciences towards the future. The final report of the Committee for the Evaluation and Development of Educational Sciences*. Helsinki:

Ministry of Education, Division of educational and research policy, 16. (in Finnish, abstract in English).

Darling-Hammond, L. (2005). Teaching as a profession: Lessons in teacher preparation and professional development. *Phi Delta Kappan*, 8(3), 237-240.

Darling-Hammond, L. (2010). *The flat world and education. How America's commitment to equity will determine our future*. New York: Teachers College.

Davenport, T. H., & Prusak. L. (1998). *Working Knowledge: How Organizations Manage What They Know*. Cambridge, MA: Harvard Business School Press.

Dreyfus, H. L., & Dreyfus S. E. (1986). *Mind over machine. The Power of Human Intuition and Expertise in the Era of Computer*. New York: Blackwell.

Finnish Higher Education Evaluation Council (2011). From http://www.kka.fi/?l=en&s=1.

Isopahkala-Bouret, U. (2005). *Joy and struggle for renewal: A Narrative Inquiry into Expertise in Job transitions*. University of Helsinki, Faculty of Behavioural Sciences, Department of Education, Research report 201.

Jussila, J., & Saari. S. (1999). *Opettajankoulutus tulevaisuuden tekijänä*. Korkeakoulujen arviointineuvoston julkaisuja 11. Edita: Helsinki.

Ministry of Education (2007). *Committee report Teacher education 2020* (Chair by Hannele Niemi). Helsinki.

Niemi, H. (1995) *Teacher professional development, part 2. Evaluation of teacher education in the frame of reference of learning experiences and new professionalism*. Reports from the Department of Teacher Education in Tampere University A 3. (In Finnish, abstract in English).

Niemi, H. (1996). Effectiveness of teacher education. A theoretical framework of communicative evaluation and the design of a Finnish research project. In H. Niemi & K. Tirri (Eds.), *Effectiveness of teacher education. New challenges and approaches to evaluation* (pp. 11- 32). Reports from the Department of Teacher Education in Tampere University A 6.

Niemi, H. (1999). ICT in Teacher education. In M. Sinko & E. Lehtinen (Eds.), *The Challenges of ICT* (pp. 145-173).

Niemi, H (2002). Active Learning – A cultural change needed in teacher education and in schools. *Teaching and Teacher Education*, 18, 763-780.

Niemi, H., & Jakku-Sihvonen, R. (2006). Research-based teacher education. In R. Jakku-Sihvonen & H. Niemi (Eds.), *Research-based teacher education in Finland – reflections by Finnish teacher educators* (pp. 31-50). Turku: Finnish Educational Research Association.

Niemi, H., & Kemmis, S. (1999). Communicative evaluation: evaluation at the crossroads. *Lifelong Learning in Europe* (LLinE), IV(1), 55-64.

Niemi, H., & Kohonen, V. (1995). *Towards new professionalism and active learning in teacher development: Empirical findings on teacher education and induction*. University of Tampere. Department of Teacher Education. Research series A 2.

Nonaka, I., & Toyama, R. (2003). The Knowledge-Creating Theory Revisited: knowledge creation as a synthesizing process. *Knowledge Management Research & Practice*, 1, 2-10.

From http://dx.doi.org/10.1057/palgrave.kmrp.8500001.

Pintrich, P. R., & McKeachie, W .J. (2000). A Framework for Conceptualizing Student Motivation and Selfregulated Learning in the College Classroom. In P.R. Pintrich & P. Ruohotie (Eds.), *Conative Constructions and Self-regulated Learning* (pp. 31-50). Hämeenlinna, Finland: RCVE.

Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 67-98). Chicago: Open Court.

Scardamalia, M., & Bereiter, C. (2003). Knowledge building. In *Encyclopedia of education* (2nd ed., pp. 1370-1373). New York, USA: Macmillan Reference.

Schön, D. A. (1991). *The Reflective Turn: Case Studies In and On Educational Practice*. New York: Teachers Press, Columbia University.

Sfard, A. (1998). On Two Metaphors for Learning and the Dangers of Choosing Just One. *Educational Researcher*, 27(2), 4-13.

Smyth, J. (1995). Introduction. In J. Smyth (Ed.), *Critical discourses on teacher development* (pp- 1-19). Great Britain: Cassell, Wellington House.

Tabachnick, B. R., & Zeichner, K. M. (1991). Reflections on reflective teaching. In B. R. Tabachnick & K. M. Zeichner (Eds.), *Issues and practices in inquiry oriented teacher education* (pp. 1-20). New York: Falmer Press.

Vokke project 2005, The Finnish project related to the European Bologna process implementation. Retrieved March, 14, 2011 from http://www.helsinki.fi/vokke/english.htm.

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Variations in Primary Teachers' Responses and Development during Three Major Science In-Service Programmes

Tina Jarvis*[1], Anthony Pell[2] and Philip Hingley[3]

This paper reports on how different types of teachers responded to in-service aimed at developing investigative-based science education (IBSE) in primary schools, and the extent to which they applied their new skills in the classroom. Common items from evaluation questionnaires allowed data to be combined from three major in-service programmes. Using complete data sets from 120 teachers, cluster analysis enabled three teacher types to be identified: a small group of 'science unsures', with low attitude scores and little confidence, who showed no response to the innovation; 'holistic improvers', who showed the largest improvement in science teaching confidence; and 'high level, positive progressives', who were very positive to science teaching throughout and showed gains in confidence in teaching physics and chemistry, as well as in demonstrating the relevance of science to their pupils. Taking account of these teacher types alongside interviews and observations, nine developmental stages in how teachers apply their new expertise in the classroom and the whole school are suggested. Major factors influencing application in the classroom are the teachers' initial science knowledge and pedagogical expertise, and motivating feedback to teachers when pupils responded positively to the innovation. Assessing teachers' initial level of subject knowledge and science pedagogical expertise to inform the approach and amount of in-service provision is important. Subsequent mentoring as well as support from the school principal when teachers first try IBSE with pupils promotes successful implementation in the classroom.

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Introduction

There is a need to overcome both the shortage of scientists and technologists in Europe that are able to compete in a world market and to enable young people to become informed citizens. The European Commission appointed High Level Group (Gago) reported in 2004 that there needs to be an increase of 1.2 million people involved in research and development in science, engineering and technology in Europe. Education systems would therefore need to increase their capacity dramatically. However, generally the European countries did not show high ratings for pupils' achievement or attitudes in the 2007 TIMSS report (Martin et al., 2008).

Osborne and Dillon (2008) maintain that the needed increase in scientists can only be achieved by increasing the quality of the experience of science education for the majority of school pupils and broadening its relevance and appeal. They argue that this should start before pupils reach 14 years old because most students develop their attitudes towards science as a subject before that age. This is particularly important because many latent scientists appear to make early decisions about their careers (Blatchford, 1992; Woolnough, 1990). Indeed, action needs to be taken in primary schools where generally pupils do have a positive view of science but there are signs that their enthusiasm is already declining as they get older (Pell & Jarvis, 2001; Woodward & Woodward, 1998).

Good and confident science teaching in the primary school is crucial as there is evidence that there is a relationship between teacher confidence and attitudes with the attitudes and attainment of their pupils (den Brook et al., 2005; Germann, 1988). Teachers with low confidence cope by only teaching the minimum required; focusing on aspects they feel more confident in, usually biology; using prescriptive texts; underplaying questioning and discussion; and avoiding practical work or only doing very simple practical work that uses very basic equipment. When these coping strategies become the norm, pupils' attainment will be limited (Harlen & Holroyd, 1997; Lee, 1995, Osborne & Simon, 1996) and their attitudes are likely to be reduced (She & Fisher, 2002).

Over the past 10 years, three major science in-service programmes for primary teachers, based on very similar principles, have been evaluated with respect to how the teachers' self-confidence in science knowledge and pedagogy changed over time as well as how they applied their new expertise in the classroom. The intention was to identify factors that promoted improved practice in the classroom.

The AstraZeneca Science Teaching Trust in-service programme, with 70 primary teachers and focused on developing investigative skills, was run in Leicester, England between 1999 and 2000 (Jarvis et al., 2003; Jarvis & Pell, 2002, 2004). In the same city, a school-based in-service programme was provided for all 11 teachers of the Oak Hill Primary School[i] (2005-2006). Most recently, Pollen & Seed Cities for Science, a community approach to the sustainable growth of science education in Europe (2007-2009), also set out to develop innovative hands-on investigative primary science. Data were collected from 765 teachers in 10 of the countries involved in Pollen. As the questionnaires used for the evaluation of each project had common items, it has been possible explore whether there were similarities in teacher response in all three projects.

The design of the three in-service programmes all took account of Joyce and Showers (1980) suggested factors of what makes effective training; namely, that training programmes should have five parts: theory (such as constructivism and the need for hands-on science); modelling or demonstration of pedagogy; practice under simulated conditions to try out a new skill with peers or small groups of children; structured feedback through self-study, peers or mentors; and supported classroom application. The training programmes ran over a period of at least one year, as a significant amount of research indicates that short courses have limited impact. A generative and constructivist approach to learning was taken, whereby learners were given personally relevant material and required to take an active part in the learning process (Glaserfeld, 1995; Wittrock, 1994). In each programme the main objective was to develop hands-on Inquiry-Based Science Education (IBSE), i.e., the intentional process of diagnosing problems, critiquing experiments and distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers and forming coherent arguments (Rocard, 2008). The programmes set out to assist teachers to develop all of these

[i] Pseudonyms are given for individual schools and teachers.

facets of IBSE, with the fundamental intention of developing science knowledge and concepts, as advocated by the USA Board of Education of the National Research Council (Duschl et al., 2007).

Despite the fact that the programmes were designed to take account of a great deal of research on factors that make good in-service training, the experience of the teachers and their pupils varied. This variation appeared to be partly related to the teachers' initial self-confidence in teaching science and their attitudes towards science. Teaching self-confidence might also be described as their efficacy belief (Park & Oliver, 2007), which is a judgement of teachers' ability to bring about the desired outcomes of their pupils' participation and learning. This self-efficacy is considered to have important influence on teachers' behaviour and related student achievement and motivation (Bandura, 1977; Tschannen-Moran & Hoy, 2001).

Writers about self-efficacy point out that teachers pursue activities and situations in which they feel competent and avoid those in which they doubt their ability to perform successfully. Guskey's (1988) research indicates that higher teacher efficacy results in a greater willingness to try new teaching strategies, while those who have lower levels of self-efficacy appear to be the least receptive to training and new ideas. In other words, those needing in-service are the least likely to want to be involved. Therefore, teachers who volunteered to be part of programmes such as Pollen may be more likely to respond to training compared to teachers who were required to join the AstraZeneca and Oak Hill programmes because they had difficulties teaching science. Therefore, part of this research explored teachers' self-confidence in science knowledge and skills before and after in-service.

Once teachers join an in-service programme there is then an interactive relationship between success in learning, perceptions of self and motivation. Achievement fosters a positive view of self, which motivates and prompts further learning (Stein & Wang, 1988). Taking this into account, Stein and Wang suggest that in-service needs to foster teachers' interest in maintaining innovative school improvement and their commitment to do so. They write that teachers need monitored support for the on-going use of new knowledge in the classroom, with feedback on their progress in order to enhance their self-efficacy. Researchers consider that this feedback is generally provided by in-service trainers, school managers and positive results in pupil outcomes. Guskey (1986) states that change in teachers' attitudes takes place primarily after in-service and when some change in student learning has

been evidenced. Consequently another element of this research was to explore if and how teachers implemented new ideas in their classroom, introduced during in-service, as well as the extent that school-based factors influenced change. In summary this research explored:

- How different teachers responded to in-service with respect to their self-confidence in science knowledge and pedagogy;
- The relationship between implementation in the classroom and teachers' self-confidence, science knowledge and pedagogy; and
- Other related factors that influenced the quality and speed of implementation of new practice in the classroom.

Method

Sample

The AstraZeneca Project involved 31 schools, 70 teachers and 1878 pupils aged 6-12 in Leicester, England (1999-2000). The schools had intakes from socially deprived areas and were underperforming in national science tests and/or were identified in government reports as having science as a weakness. All of the teachers took a ten-day course (spread over six months) on developing and assessing investigations. It covered developing open-ended investigations in the areas of electricity, melting, evaporation and dissolving, and friction. Teachers and pupils completed attitude questionnaires before the in-service and afterwards, in July 2000.

Eleven teachers from Oak Hill primary school, with over 300 pupils in Leicester, had an in-service programme after the AstraZeneca Project had finished. The teachers had not taken part in the previous project. Most of them had very low levels of competence and self-confidence in teaching science. Following paired or individual interviews to identify personal needs, they were given intensive in-service, in groups of two to four, aimed at developing pupils' investigative skills directly related to the science concepts currently being taught in the classes. There were 10 two-hour in-service sessions during 2005-2006. Most of the teachers had two sessions, but a few teachers had three. Again teachers completed attitude tests before and after the in-service.

During 2007 – 2009 data was collected from 420 teachers from 10 countries: Brussels (Belgium), Leicester (England), Tartu (Estonia), Saint-Etienne (France), Berlin (Germany), Vac (Hungary), Perugia (Italy), Loures-Sacavem (Portugal), Ljubljana (Slovenia) and Stockholm

(Sweden) who were taking part in the Pollen project. This project involved one 'seed' city in each country over 3½ years. Every 'seed' city had the aim of promoting practical investigative work while making use of local organisations, industries and facilities. Teachers were given several training sessions focused on developing investigative skills. Most teachers received between 20 and 40 hours of training per year. Support was also provided by written units of study with guidance for practical activities. For example, the Portuguese had 22 learning units of practical ideas and pedagogical advice on a website. In a number of cases these units were also supported by kit boxes with all of the equipment needed for a class to carry out the activities.

Instruments and research design

Questionnaire items common to all three projects were used for this research.

Additional qualitative data were collected from observations and interviews of all of the Oak Hill teachers; several classroom observations of most of the English Pollen teachers; interviews of 33 teachers from Sweden, Germany and England participating in the Pollen project; and interviews of Pollen trainers and coordinators. English pupils involved in all of the projects also completed pre-attitude and post-attitude questionnaires at the same time as their teachers. These additional data provide supportive information and indications of teachers' development with regard to the application of their new knowledge in the classroom.

All three project questionnaires were based on an instrument with a science attitude scale of 49 items with 0.96 overall reliability comprising six sub-scales (Pell & Jarvis, 2003). The questionnaires asked for:

- personal information, such as size of class and years of experience as a teacher;
- responses to a 5-point Likert scale asking for teachers' self-confidence in teaching their home language, mathematics, information technology, as well as science, where a score of five indicates the teacher feels very confident with no problems and a score of one indicates the teacher feels that he/she is not confident at all and needs more help with this.
- A similar 5-point Likert scale probed self-confidence in teaching biology, chemistry, physics and investigations; and there were

- 5-point Likert statements probing attitudes towards various aspects of teaching science.

All but one of the confidence items were common to all three projects. One missing item on the Pollen confidence items means that single rather than composite scores have to be compared. A number of the attitudinal statements were adapted in the Pollen project to clarify statements that might have been understood in different ways in different countries. There were also items about working in the science community, which was an additional focus of the in-service training in the Pollen project. Once these are removed, there are 28 items that are common to all three projects with occasional very minor rewording.

Results

Factor analysis of the 28 items provides five coherent scales, which were built around the 20 strongest loading items that tested for practical Alpha reliability greater than 0.70, (Aron & Aron, 1999; Youngman, 1979), can be seen in Table 1. The low reliability of the two-item *Testing* factor is unsurprising and inferences drawn from scores should be treated with caution. The remaining 8 unallocated items (see Table 2) form a further two minor factors but these are too weak for practical use. The five main factors are:

1 *Social dimension to science learning*, which indicates teachers' valuation of pupil collaboration in learning about science in a wider social context. This unidimensional factor accounts for 67% of the total variance of its items.

2 *Continuous teacher professional development*, which shows how much teachers value support for their own professional development (69% of the total variance of its items).

3 *Testing* for assessing the success of lessons and pupils' learning has a factor that accounts for 71% of the total variance of its two items.

4 *Quality support to science learners* gives a view of how teachers value the importance of strategies for building up science understanding. A second factor analysis of the scores from just the seven items in this scale shows that the factor is unidimensional, though weak, accounting for just 41% of the item variance of its items.

5 *Observational, experimental science* focuses on the importance of developing investigational skills. The factor analysis of the scores from these four items also shows that the factor is unidimensional. It accounts for 55% of the variance of its items.

Table 1. Factors from the common attitudinal items (n=327)

Factor	Questionnaire items: Teachers' views of how important it is to:	Corrected Item-Total Correlation
Social dimension to science learning Alpha = 0.74	Link new science learning to everyday experiences	0.53
	Show pupils how classroom learning relates to the outside world	0.65
	Encourage pupils to learn from each other	0.54
Continuous teacher professional development Alpha = 0.76	Change learning materials to keep up with latest developments	0.55
	Take in-service courses on science knowledge	0.72
	Take in-service courses on how to teach science	0.53
Testing Alpha = 0.62	Design tests to give information on how successful the lesson was	0.46
	Use tests that require pupils to use their learning in a new situation	0.46
Quality support for science learners Alpha = 0.75	Give each science lesson a clear introduction and conclusion that summarises the learning	0.37
	Explain to pupils why their science activity is important	0.52
	Expect pupils to use scientific words correctly	0.49
	Provide reference sources for pupils to use	0.51
	Encourage and help pupils to write notes	0.41
	Relate pupils' learning to science of the past	0.49
	Relate each new idea (concept) to ones that pupils have already learnt	0.52
Observational, experimental science Alpha = 0.73	Encourage pupils to make careful observations, repeating them if necessary	0.47
	Help pupils to generalise from observations	0.54
	Encourage pupils to plan their own investigations	0.55
	Help pupils to recognise and control variables inan experiment	0.51

Confidence and attitudinal changes after in-service

When scores are pooled across the three projects, there were significant gains between pre-tests and post-tests in the teachers' confidence to teach sciences, information technology and the home language. Attitudes to science teaching remain stable with the exception of an improvement in the rating of the use of information technology (Table 2).

Table 2. Overall confidence and attitude pre-test and post-test results for the three projects

	Pre-test			Post-test		
	Mean score/ item	Std. dev.	n	Mean score/ item	Std. dev.	n
Confidence in teaching						
Home language	4.14	0.75	170	4.25 [s]	0.81	170
Mathematics	4.21	0.81	167	4.31	0.71	167
Science	3.52	0.94	177	3.98 [mm]	0.78	177
Information technology	3.03	1.20	163	3.29 [ss]	1.10	163
Biology	3.80	0.85	172	4.05 [ss]	0.81	172
Chemistry	3.21	1.07	170	3.69 [mm]	0.91	170
Physics	3.09	1.07	169	3.54 [ss]	1.05	169
Attitudinal scales						
Social dimension to science learning	4.54	0.54	189	4.60	0.48	189
Continuous teacher professional development	4.32	0.64	185	4.35	0.60	185
Testing	3.77	0.79	184	3.85	0.77	184
Quality support to science learners	4.06	0.54	173	4.12	0.44	173
Observational, experimental science	4.32	0.51	186	4.39	0.49	186
Unallocated attitude items: Views of the importance of						
Being able to demonstrate experiments	4.31	0.79	193	4.21	0.84	193
Encouraging pupils to guess and speculate	4.67	0.59	193	4.72	0.57	193
Using a range of questioning skills	4.30	0.75	180	4.39	0.70	180
Arranging for pupils to work in groups	4.26	0.85	192	4.24	0.83	192
Frequently revising earlier learning	4.22	0.74	190	4.27	0.75	190
Using information technology	3.70	0.90	178	3.92 [ss]	0.83	178
Making sure there are enough learning resources	4.50	0.68	186	4.50	0.67	186

Evaluating science books and resources	3.77	0.85	182	3.82	0.93	182

[mm] Sig gain on post-test, p<1%, Wilcoxon matched pairs, medium effect size

[ss] Sig gain on post-test, p<1%, Wilcoxon pairs, small effect size

[s] Sig gain on post-test, p<5%, Wilcoxon pairs, small effect size

The AstraZeneca sample differs from the overall pattern in that there was an insignificant change in the confidence in teaching English. Similarly, when examined alone the Pollen sample of teachers showed no significant change in teaching their home language. In addition, the Pollen teachers' confidence in teaching biology did not show a significant change. The Oak Hill sample is very small (n=6 or 7 for test/re-test) and shows no significant changes apart from the item about encouraging pupils to guess and speculate, which increased from 3.57 to 4.43 (std.dev.0.54 and n=7, p<5%, large effect size).

Teacher types

The overall pattern masks the fact that individual teachers responded to the in-service in very different ways. Using 120 teachers with complete data sets, cluster analysis separated the teachers into relatively homogeneous types who differed significantly on the variables relating to confidence in teaching science and attitudes. Three main types were identified:

1. Science unsures
2. Holistic improvers
3. High level, positive progressives

1. Science unsures

There is only a small group of seven teachers in the first type. Their mean scores are below those of other teachers in all of the variables. They had very low initial confidence in physics and chemistry, differing from the means for the other teachers with large effect sizes, which showed no significant improvement by the time of the post-test. Their initial low attitude scores (though still positive) on the *Social dimension to science learning*, *Quality professional support to science learners* and *Observational, experimental science* also show no significant change by post-test and remain below the average (Table 3). There were significant deteriorations in the mean scores for the importance of individual items 'Being able to demonstrate experiments' and 'Encouraging pupils to guess and speculate'. Their view was that the in-service

was not successful, as their attitudes to *Continuous teacher professional development* dropped significantly below average after the projects.

Five of the seven *Unsures* were part of the Pollen project and two came from the AstraZeneca Project. The one German teacher in this group was interviewed. She had never taught science before despite having taught for more than 30 years. She only took part in two in-service sessions and found the in-service handbooks a little confusing in parts. When she was interviewed she gave the impression that teaching science was a burden to her, as it required extra input from her that she was unwilling to give. The other four Pollen teachers came from Belgium, where teachers are mainly non-graduates in a wide range of schools, with varying philosophies and status, so that it is not possible to impose strict curriculum guidelines that might give structure. Therefore, it appears that in a few cases this in-service did not have any impact because it did not last long enough to overcome both weaknesses in science teaching and science knowledge.

Table 3. Science unsures (n=7) pre-test and post-test changes in confidence and attitudinal scale scores

Attitude scale/item	Pre-test		Post-test	
	Mean score/ item	Std. dev.	Mean score/ item	Std. dev.
Confidence in teaching				
Home language	4.43	0.79	4.43	0.98
Mathematics	4.00	1.00	4.00	1.00
Science	2.71	1.11	2.57	0.54
Information technology	2.86	0.35	3.29	1.11
Biology	3.00	0.82	3.43	0.79
Chemistry	1.86	0.90	2.29	1.11
Physics	2.14	1.22	2.14	1.22
Attitudinal scales				
Social dimension to science learning	3.67	0.51	37.6	0.76
Continuous teacher professional development	4.00	0.47	3.86	0.33
Testing	3.57	0.9	3.43	0.53
Quality support to science learners	3.49	0.61	3.41	0.5
Observational, experimental science	3.82	0.49	3.57	0.4

2. Holistic improvers

This group of 41 teachers generally had initial attitude scores above the mid-points of the scales, although their scores are below

average in comparison with the whole group. While their attitudes at post-test show no significant change, they show a significant increase in teaching confidence on all of the confidence scales (Table 4). In all three sciences the improvements in confidence for these teachers are much greater than those for *High level progressive* teachers. The growth in all-round confidence points towards a holistic improvement in classroom performance. Participation in the in-service appears to have had a positive effect on all of their teaching.

The *Holistic improvers* are dominated by 26 AstraZeneca teachers and 4 from Oak Hill Primary, all of whom came from schools that were identified as having poor science results. Therefore, it might be expected that these teachers would have poorer attitudes compared to the majority of Pollen teachers, who typically volunteered to take part in the innovative European project. This group of *Holistic improvers* appears to represent an early developmental stage in how teachers respond to in-service.

In addition, 7 of the 11 Pollen teachers in this group came from England. It was noticeable that England was one of the Pollen countries where there were generally poorer overall attitudes. This appeared to be related to a closely controlled and demanding science curriculum, where pupils were tested and teachers inspected. Typically one English teacher said "I think [the Pollen project] has a massive impact. Of all of the professional opportunities I've had, it's been about the best. It's changed my view of what I am doing in the classroom and had a massive influence on my teaching… I felt my class weren't as motivated, but that's nothing to do with the Pollen project, that's to do with other issues… we're so desperate to get our SATs (national tests for pupils) up, and the kids have kind of picked up on that and it's less motivating to work under those conditions." The teachers' ability to apply their new ideas in the classroom is clearly influenced by a number of factors that relate not only to the educational system they are working in but also to their personal motivation and that of their pupils.

Table 4. Holistic Improvers (n= 41) pre-test and post-test changes in confidence and attitudinal scale scores (n=41)

Attitude scale/item	Pre-test		Post-test	
	Mean score/item	Std. dev.	Mean score/item	Std. dev.
Confidence in teaching				
Home language	3.76	0.54	4.07[ss]	0.52
Mathematics	3.83	0.92	4.12[s]	0.60
Science	3.20	0.93	3.95[ll]	0.71
Information technology	2.59	1.31	3.00[mm]	1.05
Biology	3.59	0.77	4.05[mm]	0.59
Chemistry	3.29	0.84	3.85[ll]	0.76
Physics	3.20	0.84	3.71[mm]	0.93
Attitudinal scales				
Social dimension to science learning	4.32	0.38	4.39	0.41
Continuous teacher professional development	3.89	0.63	3.95	0.50
Testing	3.57	0.5	3.57	0.53
Quality support to science learners	3.82	0.35	3.90	0.33
Observational, experimental science	4.15	0.46	4.20	0.40

[ll] Sig gain on post-test, p<1%, Wilcoxon pairs, large effect size

[mm] Sig gain on post-test, p<1%, Wilcoxon pairs, medium effect size

[s] Sig gain on post-test, p<5%, Wilcoxon pairs, small effect size

[ss] Sig gain on post-test, p<1%, Wilcoxon pairs, small effect size

3. High level, positive progressives

64 teachers were in the third group based on the cluster analysis. 58 of these teachers were from the Pollen project, 4 from AstraZeneca and 2 from Oak Hill Primary. They had above average (for the survey sample) initial science confidence and were more confident with regard to mathematics and information technology than the other two groups. The in-service appeared to boost their confidence in physics and chemistry but not biology, in which their confidence was already relatively high (Table 5). They also had significantly above-average attitude scores on all five attitude scales at both pre-test and post-test. Following in-service there is a significant improvement on the *Social dimension to science learning* scale.

While further cluster analysis of the *Holistic improvers* primarily relates to variations of increased confidence in teaching one or more science subjects, additional cluster analysis of *High level, positive progressives* indicates more complex variations with respect to confidence and/or attitudes. This latter type can be split into three subgroups:

- One subset had significantly higher confidence scores in teaching all three sciences and information technology. Confidence scores remained high but did not show improvement as the others caught up. These teachers appeared to consolidate their pedagogical learning as they showed significantly higher attitude changes with regard to *Observational, experimental science.*
- The second subgroup showed significantly high stable attitudes while their science teaching confidence was only average. They also scored highly on unallocated items that broadly express attributes of good pedagogical practice. Their results indicate that they were well motivated towards science but lacked high subject expertise.
- The third subset is exclusively Pollen teachers and showed a significant improvement on the *Social dimension to science learning scale.* They appeared to have expertise in mathematics and information technology initially and gained confidence teaching physics and chemistry. While their attitudes were average for *High level positive progressives,* this subgroup were strong believers in group work and in encouraging pupils to predict and speculate. They responded well to the specific Pollen foci on developing pupils' investigative skills and showing how science relates to everyday life. They appear to have had sufficient science knowledge and investigative skills to branch out to be more creative. One Swedish teacher in this group illustrated her ability to make links beyond the classroom when she said 'When we grow seeds we go out into the woods and parks to look for things. When we are working with chemistry we discuss what they do in their own kitchen… and when we work with electricity we help them look for things at home.'

Nine countries involved in Pollen have representatives in the *High level progressives* group. The interviews of this group confirm the generally high initial confidence and positive response to the in-service and the subset analysis. The one English teacher and most of the seven German teachers of this type who were interviewed were originally secondary science teachers who were now teaching science to primary aged pupils. They knew that while much of their science knowledge was good, they needed to develop better pedagogical skills suitable for

younger pupils. In contrast, other German teachers were talented primary teachers but needed support in their science knowledge. Unlike the *Science unsures*, these teachers had expertise that gave them confidence, or efficacy, to build on either science or mathematical knowledge, or pedagogical expertise. To make the most of an in-service programme requiring considerable application in the classroom teachers need initial self-efficacy or self-confidence in their basic skills.

Table 5. High Level, Positive Progressives (n=64) pre-test and post-test changes in confidence and attitudinal scale scores

Attitude scale/item	Pre-test		Post-test	
	Mean score/item	Std. dev.	Mean score/item	Std. dev.
Confidence in teaching				
Home language	4.17	0.81	4.14	0.89
Mathematics	4.48	0.50	4.41	0.71
Science	3.88	0.85	4.13[s]	0.75
Information technology	3.45	1.01	3.55	1.11
Biology	4.09	0.77	4.11	0.88
Chemistry	3.35	1.10	3.71[ss]	0.99
Physics	3.24	1.07	3.56[ss]	1.05
Attitudinal scales				
Social dimension to science learning	4.71	0.37	4.82[s]	0.28
Continuous teacher professional development	4.48	0.47	4.56	0.46
Testing	4.03	0.7	4.08	0.70
Quality support to science learners	4.27	0.41	4.28	0.39
Observational, experimental science	4.41	0.48	4.52	0.47

[s] Sig gain on post-test, p<5%, Wilcoxon pairs, small effect size

[ss] Sig gain on post-test, p<1%, Wilcoxon pairs, small effect size

Developmental stages of teachers' changing practice following in-service

It can be seen from the above account that there were major differences in initial teachers' attitudes and efficacy/self-confidence before the in-service and in their subsequent development. The observations and interviews enable us to relate these and to suggest possible stages of impact in the classroom. These stages extend Joyce and Showers's (1980) developmental levels of impact that might be expected during in-service. Their first three levels primarily focus on teachers' personal skills and conceptual knowledge, while the fourth focuses on classroom practice. Their stages are:

1. Awareness – where the learner realises the importance of an area and begins to focus on it. For example, the teacher recognises the value of a structure for supporting pupils' investigative skills.
2. Concepts and organised knowledge, which involves both content knowledge and an appreciation of how learners develop cognitive knowledge.
3. Principles and skills that provide the tools for action, such as the pedagogy required to help pupils to collect and organise data, and to build and test concepts.
4. Application and problem solving, when the teacher is able to transfer their new expertise to the classroom, where the new teaching strategy is integrated into the teachers' repertoire and style.

Many *Science unsures* include teachers who are still at Joyce and Showers's first three stages. They need substantial and sustained in-service focusing on their personal science knowledge and investigative skills. However, there is also a group of *Science unsures* teachers who appear to have the basic science knowledge and skills but are not motivated to apply them. The *Holistic improvers* have some confidence, which needs to be built up to a level where the teacher is motivated to change his/her practice. Although this motivation might be supported by school managers, colleagues and trainers, positive pupils' reactions appear to be a major factor in development. The *High level, positive progressives* have the advantage of initial high levels of confidence in either science knowledge or pedagogy. This generally allows them to be more creative in the classroom. However, despite the teacher becoming even more positive, if their pedagogical skills do not reach a stage where pupils are intellectually stimulated improvement in the classroom will be slow. Harlen (1997) states that teachers need pedagogical strategies for handling children's questions and turning them to the advantage of investigative learning at their finger tips, but they also need sources of information and a level of general understanding that facilitates the quick and effective use of these sources.

Taking account of these teacher types, as well as interviews and observations, nine developmental stages overlapping and extending Joyce and Showers's fourth step are suggested:

1. *Lacks the motivation to apply the knowledge and expertise to the classroom.* For example, Margaret from Oak Hill, while being proud that she had carried out two investigations in her class, did not like the feeling of losing control. Consequently, she avoided doing all of the practical work herself and asked a classroom assistant to do it with small groups outside her classroom area. Margaret was about to retire so had little reason to change her practice.

2. *Self-confidence increases so that the teachers improve their attitude to science but appear to make limited effective change in their class*. Grace and Wendy are examples of teachers who have either expertise in pedagogy or science knowledge but not both. It is only when both are established that change is seen in the classroom. Before the in-service, Grace, a *Holistic Improver* at Oak Hill, said that she did not enjoy science at all because she felt inadequate. She took an active part in the in-service, which had a very positive effect on her self-confidence and attitudes. However, she did not do any 'pure' investigations. She did include some science concepts alongside her literacy-based story-telling activities. Language was her strength and this provided the beginning of a basis to build up her confidence to teach science. In contrast, as a secondary science teacher Wendy (Pollen) was scientifically knowledgeable. She also noticeably enjoyed the social and intellectual stimulation of the in-service, with the effect that her improved confidence and attitudinal scores classified her as a *High Level Progressive*. However, while she applied her new ideas in the classroom, the activities were too easy for the pupils, resulting in her pupils showing significant attitudinal falls with regard to liking science in school. (In the year since the administration of the questionnaires, in-service continued and Wendy improved her pedagogical skills and is now consistently providing stimulating investigative activities.)

3. *Teachers replicate activities shown in in-service sessions.* During the in-service programme, the teachers were rather cautious at

first and tended to be fairly directive with the pupils because the activities were new to them. Usually the children reacted with increased interest and behaved well, proving that they could respond well to this approach. The pupils' positive response increased the teachers' self-confidence and desire to continue with the new approach. The close relationship between the type of activity and the pupils' response was seen in Louise's (Pollen) class. Louise tried out several activities that involved the community but she did not develop as many practical investigative activities as she might have. Her pupils' attitudes to science's value in society increased significantly, but their views about doing investigations did not. This indicated that they were only responding positively to this new rather narrow focus. As pupils became enthusiastic, Louise's confidence in teaching science showed a strong improvement.

4. *Activities are repeated and adjusted to cater for individual children's needs and/or the situation in the class.* Angela, a *Holistic improver* from Oak Hill, lacked confidence and actively disliked science. She had avoided teaching any science by taking colleagues' physical education classes, as she had very poor science knowledge. She was initially very reluctant to participate in the first in-service session, but was drawn into the practical nature of the activities. She did two of the activities from this first in-service in her class and was pleasantly surprised by the children's response, and by the fact that it had been easy for her. After this initial success, Angela was keener to use the in-service to plan lessons, and started to creatively adapt each activity to fit the needs of the pupils. As the teachers received positive reactions from the pupils they became more daring and took greater risks, thus starting to add and develop ideas from the in-service within the same topic. As their confidence increased they moved towards a greater partnership with the pupils, who were given more independence and say in the activities.

5. *The principles shown in the in-service are applied in a new topic/age group*. One Pollen teacher, Tamara from Broadside

School, applied in-service ideas to the whole school age range. The visiting tutor reported that she had observed lessons for 5-year-olds to 11-year-olds where Tamara had skilfully adapted the basic principles from the in-service to meet the objectives of all or the age groups, such as enabling the 11-year-olds to do investigations about light so that they could teach 6-year-olds using appropriate language for the younger pupils.

6. *There is an increased sharing of work within the school with other colleagues.* Towards the end of the in-service programme, the two Holistic improvers and Tamara from Broadside collaborated to promote the Pollen ideas in their classes, as well as at whole-school assemblies and staff meetings. These whole school activities showed that children could respond well to independent investigative work. Tamara persuaded other teachers who had not attended the in-service to let her plan and demonstrate lessons that they had been reluctant to try as they felt the children would find the work too difficult. When they saw Pollen-type lessons in action and witnessed the benefits first-hand, they were encouraged to continue this approach. The three teachers taking the in-service were not deterred by the strong initial resistance and eventually managed to get other staff members interested. It was clearly advantageous that the group of three teachers had attended the in-service together and were able to give each other moral support.

7. *Changes are seen in whole-school planning. Year groups and classes make partial changes to include the new approach*. Observers noted that in a few English Pollen schools at the end of the three years of the Pollen project, course participants had started to make changes in collaborative planning affecting several teachers. For example, in one school the traditional topics were rearranged so that logical links could be made more easily between science and other subjects in order to show how science is relevant in many situations.

8. *Whole-school change of approach.* None of the English schools in the Pollen project had, after three years, changed their whole-school plans to optimise a cross-curricular hands-on investigative approach, although some were getting close to that stage. The majority of the teachers in the school, including those who had not attended the in-service programme, needed to be confident and able to teach investigative science. It was clear that there would also need to be changes in timetabling, which would affect other subjects. In addition, changes in organisation were often required to ensure the availability of equipment. Furthermore, the possibility for such a major change only occurs once a year when major planning for the next academic year takes place.

Conclusion

Teacher questionnaire results were combined and compared across three projects that have taken place in Leicester, England and other European countries over the past ten years. At the broad project level, there were few differences between the AstraZeneca, Oak Hill Primary and Pollen samples. Overall, there were significant gains in the confidence of teaching sciences, information technology and the home language. Attitudes to science teaching remained stable with the exception of an improvement in the rating of information technology use.

However, the overall evaluation of an in-service programme can only give a superficial view, as results are made up of a variety of responses. Using cluster analysis, three major teacher types were identified:

- *Science unsures*, a small group with low attitude scores and little confidence, who showed no response to the innovation;
- *Holistic improvers*, who showed the largest improvement in science teaching confidence as well as becoming more confident across the curriculum. Their average attitudes to science teaching remained stable throughout; and
- *High level, positive progressives*, who were the largest group. They were very positive towards science teaching throughout and showed gains in confidence in teaching physics and chemistry, as well as in ways of making links between their science activities and everyday social activities.

At a more precise level of analysis, the second and third teacher types were found to comprise sub-types that differ significantly from one another, indicating that the AstraZenca and Pollen projects had drawn on different teacher-type profiles at the outset. Observations and interviews provided an opportunity to build on the cluster types in order to develop a possible developmental model that teachers go though before new practice is established first in the classroom and then in the whole school.

Cluster analysis found that the teachers' starting point of development was strongly affected by their attitudes to science, as well as by their efficacy or self-confidence in their science knowledge and scientific pedagogical skills. While it is not surprising that inexperienced teachers need a longer in-service programme and many opportunities to practice their new skills, the speed of each teacher's development during the in-service did not depend entirely on where they started. While initial self-confidence was important, motivation prompted by personal success and a positive response from the pupils were key factors. This finding generally supports the view of researchers into teacher efficacy that feedback about success in applying new skills after in-service is very important (e.g., Guskey, 1986). However, while a positive response from peers and management, as well as results of attainment, do partly provide this feedback, these researchers do not appear to have recognised pupil enthusiasm as also being very important.

Initial self-confidence in both science knowledge and the pedagogy of teaching science are major factors. Without both, improvements in the classroom may not occur or may even have a negative effect. Once the teachers had enough confidence and ability to successfully apply their new knowledge and skills in the classroom the pupils' response was very important. If the teachers were able to present the lesson satisfactorily the children usually reacted with increased interest and behaved well. This motivated teachers to continue the new approach. Providing sufficiently demanding tasks by encouraging independence and making conceptual challenges appears important in improving pupils' attitudes. This relates to Pell and Jarvis's (2001) finding that pupils' enthusiasm for science declines if they perceive it to be too easy.

Once having overcome the first hurdle of introducing the new activities successfully, the teachers continued to replicate activities demonstrated in the in-service. This process was again usually encouraged by the response of their pupils, but also by the response of

colleagues and managers in the school. Some teachers increasingly became more daring and took greater risks to add/develop ideas from the in-service. As they gained greater confidence they moved towards a greater partnership with the pupils, who were given more independence. It was clear that a feedback cycle needed to be in place: the provision of stimulating hands-on science that excited pupils increased teachers' efficacy to prompt more demanding and stimulating tasks for pupils and so on.

Development was initially focused on individual teachers' classrooms. Teachers did not involve other colleagues in their school until they felt confident in themselves and their pupils. Once this stage was achieved teachers were keen to share their new skills with colleagues and in so doing gained further kudos and confidence. Generally effective whole-school dissemination did not appear to be feasible until this point. Of course, colleagues in their school also needed to go through a developmental process. This was supported in a variety of ways, such as informal peer mentoring, internally run staff in-service sessions, visits by project tutors and trial whole-school activities. For example, some English Pollen schools tried 'Creative Days' or one 'Creative Unit' a year alongside more standard science units. To enable a whole school to change will take several years, particularly as major planning changes are only made once a year.

When designing new in-service programmes it is important to assess teachers' initial level of self-confidence in both science subject knowledge and science pedagogy, such as Inquiry-Based Science Education (IBSE) skills. These need to be addressed first by teachers doing investigations for themselves and having time to understand the underlying science concepts. In all three projects teachers valued trying and extending the investigations that they would later give to the pupils. This stage may take some considerable time if the teachers' original expertise is low.

Encouraging teachers to try out new activities in the classroom is a major challenge, but it is essential in order to trigger the feedback loop of teacher and pupil motivation. Strategies that have been found to work in these three projects include having two or three teachers from the same school taking the in-service together so that they give each other peer support, as well as enabling trainers or mentors to visit classrooms to participate and to support the teacher, not to assess him/her. Teachers found it difficult not to try the activities when they were visited by their mentor. The mentors were also able to give some advice

on ensuring that the level of difficulty was appropriate. In England, the visiting mentors also wrote short reports from each visit, illustrated with photographs, in order to produce high quality glossy booklets (www.scicentre.org.uk) to show the teachers that their work was valued. The booklets were also designed to keep school principals and governors informed about the project, as in-service was also most effective in schools where senior managers fully understood its potential for raising standards and were committed to using it as a key driver for school improvement (OFSTED, 2006).

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References

Aron, A., & Aron, E. N. (1999). *Statistics for psychology*. New Jersey: Prentice Hall.

Bandura, A. (1977). Self-efficacy: Towards a unifying theory of behavioural change. *Psychological Review*, *84*(2), 191-215.

Blatchford, P. (1992). Children's attitudes to work at 11 years. *Educational Studies, 18*, 107–118.

den Brook, P., Fisher, D. & Scott, R. (2005). The importance of teacher interpersonal behaviour for student attitudes in Brunei primary science classes. *International Journal of Science Education, 27*(7), 3,765–779.

Duschl, R. A., Schweingruber H. A., & Shouse A.W. (Eds.) (2007). *Taking science to school: Learning and teaching science in grades K-8.* Washington, DC: National Academies Press.

Gago, J. M. (2004). Increasing human resources for science and technology in Europe. Brussels EC conference 'Europe needs more scientists' 2 April.

Germann, P. J. (1988). Development of the attitude toward science in school assessment and its use to investigate the relationship between science achievement and attitude toward science in school. *Journal of Research in Science Teaching, 25*, 689-703.

Glasersfeld, E. von (1995). *Radical constructivism: A way of knowing and learning.* London: Falmer Press.

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. *Teaching & Teacher Education*, *4*(1), 63-69.

Harlen, W. (1997). Primary teachers' understanding in science and its impact in the classroom. *Research in Science Education, 27*(3), 323-337.

Harlen, W., & Holroyd, C. (1997). Primary teachers' understanding of concepts of science: impact on confidence and teaching. *International Journal of Science Education, 19*(1), 93–105.

Jarvis, T., & Pell, A. (2002). Changes in primary boys' and girls' attitudes to school and

science during a two-year science in-service programme. *The Curriculum Journal*, *13*(1), 43-69.

Jarvis, T., & Pell, A. (2004). Primary teachers' changing attitudes and cognition during a two-year science in-service programme and their effect on pupils. *International Journal of Science Education*, *26*(14), 1787-1811.

Jarvis, T., Pell, A., & McKeon, F. (2003). Changes in primary teachers' science knowledge and understanding during a two year in-service programme. *Research in Science & Technological Education*, *21*(1), 17-42.

Joyce, B., & Showers, B. (1980). Improving in-service training: the messages of research. *Educational Leadership*, *37*(5), 379-385.

Lee, O. (1995). Subject matter knowledge, classroom management, and instructional practices in middle school science classrooms. *Journal of Research in Science Teaching, 32*(4), 423–440.

Martin, M. O., Mullis, I. V. S., & Foy, P. (with Olson, J. F., Erberber, E., Preuschoff, C., & Galia, J.) (2008). *TIMSS 2007 International science report: Findings from IEA's trends in international mathematics and science study at the fourth and eighth grades*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Office for Standards in Education (OFSTED) (2006). *The logical chain: Continuing professional development in effective schools*. London, HMI 2639.

Osborne, J., & Dillon, J. (2008). *Science education in Europe: Critical reflections.* London: Kings College.

Osborne, J., & Simon, S. (1996). Primary science: past and future directions. *Studies in Science Education, 26*, 99–147.

Park, S., & Oliver, J. S. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK); PCK as a conceptual tool to understand teachers as professionals. *Research in Science Education, 38*, 261-284.

Pell, A., & Jarvis, T. (2001). Developing attitude to science scales for use with children of ages from five to eleven years. *International Journal in Science Education*, *23*(8), 847-862.

Pell, A., & Jarvis, T. (2003). Developing attitude to science scales for use with primary teachers. *International Journal of Science Education*, *25*(10), 1273-1295.

Rocard, M. (2008). *Science education now: A renewed pedagogy for the future of Europe.* Brussels: European Commission.

She, H., & Fisher, D. (2002). Teacher communication behavior and its association with students' cognitive and attitudinal outcomes in science in Taiwan. *Journal of Research in Science Teaching, 39*(1), 63–78.

Stein, M. K., & Wang M. C. (1988). Teacher development and school improvement: the process of teacher change. *Teaching & Teacher Education*, *4*(2), 171-187.

Tschannen-Moran, M., & Hoy, A.W. (2001). Teacher efficacy: capturing an elusive construct. *Teaching and Teacher Education*, *17*, 783-805.

Wittrock, C. M. (1994) Generative science teaching. In P. Fensham, R. Gunstone & R.

White (Eds.), *The Content of Science: A Constructivist Approach to Teaching and Learning*. London: Falmer Press.

Woodward, C., & Woodward N. (1998). Welsh primary school leavers' perceptions of science. *Research in Science & Technological Education, 16*(1), 43-52.

Woolnough, B.E. (1990). *Making choices*. Oxford, UK: Oxford University Department of Educational Studies.

Youngman, M. B. (1979). *Analysing social and educational research data*. London: McGraw Hill.

Biographical note

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Innovating Science Teaching by Participatory Action Research – Reflections from an Interdisciplinary Project of Curriculum Innovation on Teaching about Climate Change

Timo Feierabend and Ingo Eilks*[1]

This paper describes a three-year curriculum innovation project on teaching about climate change. The innovation for this study focused on a socio-critical approach towards teaching climate change in four different teaching domains (biology, chemistry, physics and politics). The teaching itself explicitly aimed at general educational objectives, i.e., fostering students' communication and evaluation abilities as essential components for preparing young people for active participation in society. Participatory Action Research has been used as a collaborative strategy of cyclical curriculum innovation and research. Using past experiences and selected results from accompanying research, this project and its methodology will be reflected upon from the viewpoint of the chemistry group taking part in the project. Core issues reflected upon include how the project contributed to the creation of feasible curriculum materials, how it led to innovative structures in practice, and whether it supported experienced teachers' ongoing professional development. General considerations for the process of curriculum innovation will also be derived.

Key words: Climate change, Curriculum innovation, Participatory action research, Science education

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Teaching about climate change and science education

Climate change has become one of the most dominant science-related issues in today's political debate (e.g., Ekborg & Areskoug, 2006). It can be considered – borrowing the words of Wolfgang Klafki (2000) – to be one of society's 'key problems of our epoch'. For Klafki, these 'key problems' represent the most promising issues for educators to employ in aiding their students to achieve *Allgemeinbildung*. *Allgemeinbildung* in this sense conceptualises the central goal of any contemporary education to help students better their capabilities in self-determination, political participation and solidarity with others in a democratic society (e.g., Hofstein, Eilks & Bybee, 2011).

One typical characteristic of such key problems is that they are (still) undetermined to some degree. Although there is a huge body of literature published about the causes and potential effects of climate change (e.g., IPCC, 2007) there is still no consensus about the implications obtainable from the available data. This means we are faced with conflicting evidence and quite often contradictory opinions (e.g., Ekborg & Areskoug, 2006; Hulme, 2009). Nevertheless, decisions must be reached on both the individual as well as the political levels (Ekborg & Areskoug, 2006). Politics decides upon new regulations, e.g., the taxation of renewable energies, but each individual also continually makes relevant decisions, such as whether to drive one's own car or use public transport. The basis for many of these decisions is still undetermined, which makes climate change an interesting topic for contemporary education in general and for science education in particular. In the words of Sadler (2004): The most fruitful settings for science education are "*those which encourage personal connections between students and the issues discussed, explicitly address the value of justifying claims and expose the importance of attending to contradictory opinions*" (p. 523).

Unfortunately, nowhere is climate change education as successful as it should be (Rickinson, 2001). Deficits are reported in several areas, e.g., concerning students' understanding of the science of climate change and its possible impacts on society (e.g., Andersson & Wallin, 2000; Boyes, Skamp & Stanisstreet, 2009; Boyes & Stanisstreet, 1993, 1997; Hansen, 2010), but this is not the full extent of the lacking factors. In very few lesson examples within science education literature is climate change even connected to the learning of the societal and political dimension of the issue. The societal orientation of science

education as a whole often remains a far too neglected field (Hofstein et al., 2011). There seems to be a lack of proper strategies, materials, and their application. A recent survey of twenty German chemistry teachers' views on and experiences with teaching climate change made it clear that a reliable consensus among teachers as to when, how, and even in which school subject climate change should be taught is still lacking, at least in the case of German schools. Although all of the teachers asked supported the importance of learning about climate change, they themselves did not consider climate change an equally important issue for their curricula as compared to more traditional topics of chemistry education (Feierabend, Jokmin & Eilks, 2011).

Based on these points, the project "The Climate Change Before the Court" was established. The project lasted a total of three years (2008-2011). It is a curriculum innovation and research project for teaching climate change in four different teaching domains: biology, chemistry, physics and politics (e.g., Eilks et al., 2011a; Feierabend & Eilks, 2010). The project was funded by the German Environmental Foundation (DBU), and in 2009 it was awarded as an official German project of the UN World Decade of Education for Sustainable Development.

The project "The Climate Change Before the Court" seeks to develop and research different ways of implementing teaching about climate change in the three science subjects (biology, chemistry and physics) and also involves politics lessons as an external reference. The project attempts to pinpoint criteria for the Where and How of teaching climate change in common curricular structures in the sciences. This includes the societal point of view, the use of innovative structures, introducing student-oriented pedagogy, and focusing on students' evaluation and decision-making capabilities (Höttecke et al., 2010). As a common strategy, all school subjects selected the socio-critical and problem-oriented approach to science teaching (Marks & Eilks, 2009) and employed role-playing exercises to enhance learning about how socio-scientific issues such as climate change are handled by society. The project was driven by the Participatory Action Research model of science education (Eilks & Ralle, 2002), which represents a collaborative process of cyclical curriculum innovation and research.

In this paper, the research model and the structure of the project will both be presented. Reflection will include selected results from the accompanying research and the experiences of the participating chemistry group, including the project and research methodology.

Participatory Action Research for curriculum innovation in science education

The tradition of using action research for classroom improvement and teachers' professional development is quite well-established for education in general and in science education in particular (e.g., Bencze & Hodson, 1999; Feldman, 1996; Parke & Coble, 1997). Differences in the forms of action research are mainly connected to questions of power and control. The processes of action and research can lean either to the researchers' or to the practitioners' side (Eilks & Ralle, 2002; Eilks, Markic & Witteck, 2010). In our case, we argue that applied academic educational research focusing on curriculum development in science education should have the goal of developing strategies and materials to potentially improve practices in as many learning groups as possible. Thus, we chose an interpretation of action research that is more general and researcher-centred. The approach adopts the idea of Participatory Action Research (PAR) as described by Whyte, Greenwood and Lazes (1989) for the field of economics and applies it to science education (Eilks & Ralle, 2002). In this way, we outlined five equally important domains of objectives when using action research as a strategy for applied academic research (Fig. 1):

- The development of new concepts and materials for improving teaching and learning practices, including the evaluation and dissemination of the said strategies
- The attainment of empirical evidence on applied learning and teaching approaches within authentic teaching practice
- The development of concrete teaching practices involved in the process of deficit reduction
- In-service training of the practitioners involved pertaining to their self-awareness of how effectively they work, including improving their skills in curriculum development and evaluation
- Documentation of the settings and experiences as examples of good teaching practice

In order to reach these five objectives, the PAR research model for science education is described as a cooperative process of practitioners and accompanying scholars. This cooperative approach recognises the fact that empirically validated research results and experientially-based teacher knowledge represent the two extremes

of the knowledge spectrum of teaching and learning, and both have their own strengths and are important in their own right (McIntyre, 2005). Thus, we build cooperation between practicing science teachers in schools and science educators from university. As dictated by the foundations of action research and its roots in critical theory, everyone involved has equal status and contributes to each of the decisions made during the whole research and development process.

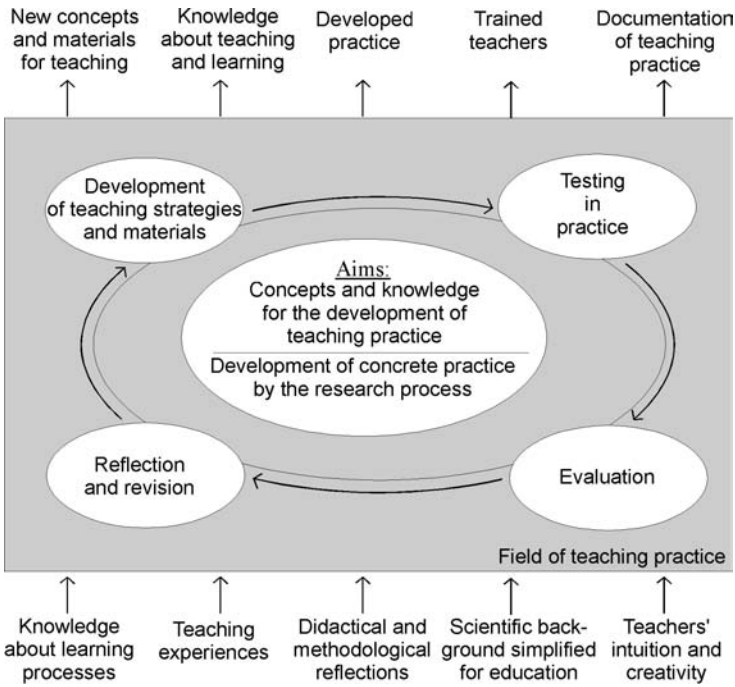

Figure 1. Participatory Action Research within domain-specific education (Eilks & Ralle, 2002)

Although all members in the action research groups have equal status, it is more helpful to simply think of them as fulfilling different roles (Altrichter & Gstettner, 1993). The "external" researchers focus on clarifying and structuring theoretical evidence as a basis for curriculum planning, justifying the changes from a theoretical perspective, organising the research process, and taking care of ethical and/or methodological issues in the accompanying research. Participating teachers concentrate their efforts on translating the new methodological elements into effective teaching practice, testing the changed

approaches and taking care of the feasibility of the efforts (Eilks & Ralle, 2002; Eilks et al., 2010). Nevertheless, all decisions are made through the consensus of the entire group.

The PAR research process is initiated by reports of deficits in teaching practices, either from hands-on experience or from empirical educational research. This is the case concerning climate change, as has been documented in a whole series of studies (see above). PAR intends to find new ways to reduce the reported problems step-by-step. The process begins with a thorough analysis of the relevant literature, which is provided by the accompanying researcher. The analysis offers a starting point for group discussions by the researchers and teachers. It allows them to determine how - and if - the problem is authentic, of interest to the teachers, and potentially beneficial for improving teaching practices beyond the individual classroom. The discussions also focus upon the evidence from the scientific literature and whether the teachers consider it to be of value for the specific educational setting in which they work. This process ensures that any strategies developed are relevant to the teachers for problems found in their own authentic classroom practices. Additional input comes from analysis of the scientific background and its integration into educational purposes, as well as from the personal experience, intuition and creativity of researchers and practitioners alike (Fig. 1).

Just like every kind of Action Research, the process of development is cyclical. New teaching materials and strategies are designed. These initial designs are used and tested as early as possible in order to see if they can potentially solve the problems being addressed. The lesson plans are then improved stepwise in ongoing cycles of testing, evaluation, self-reflection and restructuring (Fig. 1). During this cyclical refinement of teaching strategies, the perspectives of all participants (teachers, students, and researchers) are taken into consideration using a multi-perspective approach of evaluation (Eilks & Ralle, 2002). However, evaluation tools and strategies being selected as appropriate for application in authentic teaching practice usually means that, in most cases, smaller and more focused evaluation tools have been combined into a multi-perspective, triangular approach. Despite these restrictions, a whole set of different methods suggest themselves, e.g., group discussions among the practitioners, open and standardised questionnaires for the students, audio and video clips from the classrooms, personal classroom observations, analysis of student artefacts, and sample interviews with either students or teachers.

For analysis of the data, Bodner, MacIsaac and Whyte (1999) suggest that classical philosophies applying a quantitative understanding of evaluation are not appropriate for this kind of curriculum development. They warn us that far too many outside influencing factors cannot be controlled in a reliable fashion. Another reason for not applying positivistic-based philosophies of data interpretation is that both researchers and practitioners are personally involved in developing and carrying out the practices. This means that a qualitative, interpretative paradigm of research is much more suitable for PAR-type research. Nevertheless, findings must meet quality control criteria. Therefore, the validity of the interpretations is tested by communicative validation with the teachers. Altheide and Johnson's (1994) criteria for interpretative research can be used for this: plausibility, credibility, relevance and importance.

Methodology and objectives of the project "The Climate Change Before the Court"

'Climate Change Before the Court' represents interdisciplinary cooperation among educators and practitioners in the fields of chemistry, biology, physics, and political education (Eilks et al., 2011a). In addition to the university and roughly twenty different schools, some ten additional partners come from the informal sector of science education, e.g., a science centre dealing with the issue of climate, a museum of regional natural history and regional centres for informal environmental education.

In the course of the project, one group of Participatory Action Research was established for each of the four school subjects, namely Biology, Chemistry, Physics, and Politics. Each group was composed of 5-8 teachers accompanied by 1-2 domain-specific university educators from the respective field of study. The teachers came from different schools in the north of Germany and represented teaching practices in middle, grammar and comprehensive schools in both rural and municipal areas.

The groups structured their lesson plans over a time period of about two years. On average they met once a month for one afternoon in order to structure the lesson plans and materials and to report on and discuss their experiences. The meetings were also used to acquaint the teachers with current scientific information on the issue of climate change. Participants increased their knowledge of available

curriculum materials and potential school-type experiments from the scientific literature, which worked as inspiration for their curriculum planning efforts.

Objectives of the project included:

- The development of lesson plans for teaching climate change with a special focus on strengthening students' communication, evaluation and decision-making capabilities with the inclusion of a societal perspective;
- Implementing the lesson plans into practice, researching their feasibility and effects, and helping teachers in their professional development concerning the application of the respective teaching strategies; and
- Conducting accompanying research on how to deal with the challenge of climate change in domain-specific cultures among educators working in the different science teaching domains.

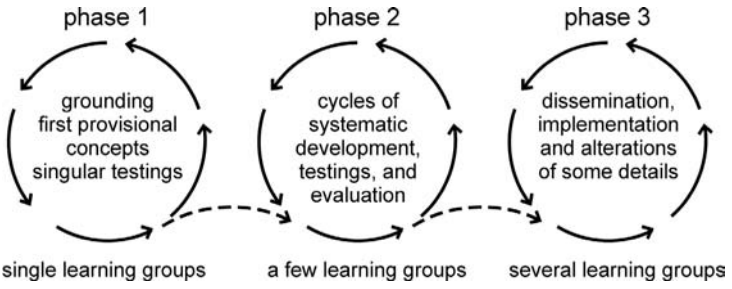

Figure 2. The three phases of the development process in PAR (Eilks & Ralle, 2002)

Following the three-phase model of PAR (Fig. 2), the lesson plans as whole - or single elements thereof - were individually pre-tested by members of the group. Broader testing took place after the first full proposal of each of the lesson plans was ready. In this phase, the lesson plans were taught parallel to one another in all four subjects. Five different learning groups tested each lesson plan and represented a good blend of middle, grammar and comprehensive school classes from northern Germany. These twenty groups in the main testing cycle led to feedback from a total of 432 students. Student feedback was collected using questionnaires containing both open and Likert-based items. Additionally, pre- and post-group discussions were conducted

in all learning groups. Both approaches focused upon lesson plan feasibility, students' viewpoints concerning climate change, and learner self-reflection on the decision-making process within the lesson plan. For later analysis of the course of the process, teacher feedback was also monitored by videotaping every action research group meeting. All data was then evaluated using qualitative content analysis (see Mayring, 2002).

Additional data was collected in order to better understand not only the domain-specific cultures of how to deal with evaluation competency, but also the changes in teachers' pedagogical content knowledge. Data from these studies are currently under evaluation and will not to be discussed in this paper.

The teaching approach within the project "The Climate Change Before the Court"

Within the project "The Climate Change Before the Court", designing the lesson plans for each subject was inspired by the socio-critical and problem-oriented approach to science teaching (Fig. 3) as originally developed by Eilks (2000, 2002) for chemistry education. The actual model applied was then refined to its present form using a whole series of examples over the last ten years (e.g., Marks & Eilks, 2009). This pattern for societal and multidimensional-oriented science education organises lessons using a five-step model. The lessons start with a current, controversial socio-scientific issue, which is presented to the students using current, authentic media (e.g., newspapers or TV). All lesson plans incorporate a second phase of learning that addresses the essential scientific background necessary for understanding at least the basics of the relevant socio-scientific issue. After this the socio-scientific debate is resumed. The central phase of learning about both society's handling of the issue and the inherent interplay between science and society is constructed by mimicking authentic societal practices. In the case of this project, a joint decision was made to apply either role-playing or a business game in this step of teaching, since this had already proved to be of value in a related pilot study on bioethanol use (Feierabend & Eilks, 2010, 2011). The lesson plans finish with meta-reflection, which focuses on the method, performance, and learning process themselves, rather than simply on the topic and its evaluation.

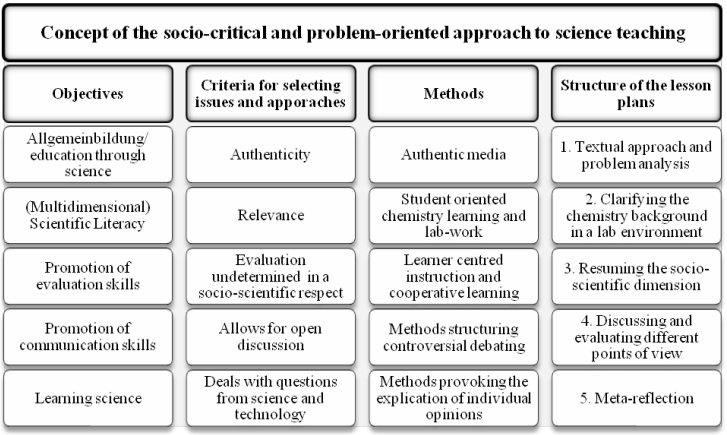

Figure 3. Conceptual framework of the socio-critical, problem-oriented approach to science teaching (Marks & Eilks, 2009).

Table 1 gives an overview of the four lesson plans. The chemistry group's teaching example has already been described in more detail in Feierabend and Eilks (2010). All teaching materials have been completed and will soon be published as a resource book for teachers interested in teaching climate change in science classes, including those using interdisciplinary and project-based teaching approaches (Eilks et al., 2011b). Upon completion of the project, parts of the materials were adopted for use by the partners from the informal educational domain. For example, the materials focusing on socio-scientific reflection about climate change are now being applied by these participants as an accompaniment to more content-focused offers already existing in their exhibition programmes.

Table 1. Overview of the lesson plans from the various projects (Eilks et al., 2011a)

	Textual approach	Science content	Role-playing scenario
Biology	Authentic magazine cover and article	Internet search and jigsaw classroom on the relationship between food production and the emission of greenhouse gases	Role-playing a school's decision not to offer meat dishes anymore in the school cafeteria
Chemistry	Satirical YouTube video on the effects of climate change	Jigsaw classroom and experimental learning-at-stations lab on the use of conventional and renewable fuels for cars and their comparison	Role-playing/business game on raising the minimum driving license age to 21 years in order to reduce the number of potential car drivers
Physics	Scientific presentation on climate change and its potential effects	Experimental learning-at-stations lab on heat absorption by gases, the radiation budget of the earth, and effects of temperature rises in the atmosphere	Role-play/business game on measures against the import of fruits brought to Europe by air transportation
Politics	TV report on the competition between food and fuel production	Reading informative texts about essential elements of the science background	Business game on establishing an embargo on the import of Brazilian bioethanol

Selected aspects of the accompanying research

In the teacher discussions during the PAR group meetings, the deficiencies mentioned in the literature (see above) were supported by the participants, including the facets dealing with individual school environments. The teachers generally acknowledged the importance of this issue, but also affirmed a lack of adequate teaching materials. In line with the literature reviews, some teachers also mentioned feelings of insecurity when teaching climate change themselves, since they did not feel sufficiently confident in their content matter knowledge. The reason stated by the teachers was their awareness of climate change's undetermined nature as an issue and uneasiness at dealing with various contradictory interpretations found in the public debate. They also

stressed that their formal training as science teachers took place long before climate change ever became an issue of concern. Furthermore, in-service trainings focusing on multidimensional approaches to climate change were not available at that time. Teachers also felt a lack in sufficient support from textbooks and teaching materials. Here, they expressed their appreciation of the course the project took. The university input given as an update to their knowledge was very well-received, including not just the information about content but also that dealing with available pedagogies and school-type experiments.

The teachers' participation in the project was acknowledged as being of great value. From the teachers' viewpoint, this project resulted in highly feasible teaching materials that they enjoyed including in their regular teaching. The teachers felt that the help from the university was very valuable for the joint development of new teaching materials, but they also expressed satisfaction that their influence on the structure of the teaching materials had been acknowledged. Also, the involvement of different types of schools (grammar, middle and comprehensive schools from both rural and municipal areas) in the two subjects where this was the case (biology and chemistry) was considered to be beneficial because this led to continuous reflection upon how the materials could be as broadly applicable as possible. In the end, the teachers felt better prepared to cope with difficult issues like climate change in their given subjects. Many of the teachers asked for further cooperation on both related and new issues. Altogether, the teachers reported a growth of personal expertise in the areas of content, methodology, and using experimental work in the classroom.

Concerning the lesson plans, the teachers reported classes that were highly student-active. The developed lesson plans were thought to be an enrichment of the pedagogies that the teachers normally applied. Student feedback on the lesson plans was also very positive. In the case of the chemistry questionnaire, pupils were asked about the lesson plan itself and their perceptions of it (see also Feierabend & Eilks, 2010). Nearly 70% of the students completely or predominantly agreed that they had enjoyed the lesson plan because it dealt with content that personally interested them. A further 20% agreed partially to this same statement. Nearly 70% of the pupils agreed that they really liked the lesson plan's methods (again with about 20% agreeing partially) because learners could work out answers together with their classmates. Most students liked the business game element as part of science teaching, although this aspect is very unconventional in German

science classrooms. Total agreement for this item was above 50% and partial agreement a further 25%. The results were similar in the other three subjects with only slight variation. In the open questionnaire, too, which was filled out before the Likert questionnaire, over 70% gave positive feedback on their own choices concerning different aspects of the lesson plan, i.e., the applied pedagogies.

From the point of view of the students, the lesson plans made them think more about climate change, with nearly 70% of the students at least predominantly agreeing with such a statement (and another 25% partially agreeing). The chemistry students came predominantly from grade 9 comprehensive and middle school classes. Agreement was slightly lower in the other subjects, which were dominated by 10th grade grammar school classes. Perhaps the higher-achieving, older students in these courses felt themselves to be more self-reflective on this topic prior to the lesson plan. Nevertheless, even among these groups between 45% (biology) and 60% (physics) of the learners positively replied to this item, with another 30% in both groups agreeing at least partially. Other items on this issue, e.g., whether students now saw the media debate with different eyes or whether their personal viewpoint towards climate change had altered, were also supported by roughly half of the pupils, with variations in the different subjects. Partial support was expressed by another 30% of the participants.

Looking at the group discussion results, we can recognise initial trends in the present state of the data analysis. In both the pre-group and post-group discussions, students recognised their responsibility for climate change on different levels (personal, political and economic). They saw a plurality of countermeasures for each level, even though the manner of argumentation differed quite widely (spontaneous vs. justified, reflective or constructive). Students were confronted with two dilemmas during the discussions: 1) a German city where pupils are forbidden to come to school by car (pre-discussion group) and 2) an EU-wide ban on conventional light bulbs, including their immediate replacement with energy-saving lamps (post-discussion group). Learners were asked to list pros and cons for each situation, which decision-makers might be included and to state their own ideas of how such decisions should be handled. Starting with these two scenarios, intense discussions occurred in all of the groups. Overall, pre-group discussion was dominated by spontaneous, personal and often poorly-justified arguments. In the post-group discussions, the number of well-reflected and evidence-based arguments increased slightly. A

more detailed analysis of the levels of argumentation is currently underway. Although one can hardly expect a single lesson plan of roughly 10 periods to cause a measurable increase in students' argumentative capabilities, evaluation skills and decision-making processes, preliminary indicators reveal that at least a small rise in students' skill development took place.

Reflection, discussion and implications

The reflection on this project should focus on two different points: 1) the outcome of the project concerning teaching and curriculum materials, and 2) the PAR method, i.e., its potential for both curriculum and teachers' ongoing professional development.

Concerning teaching about climate change, the different PAR groups clearly supported the theoretical analysis that this issue has high potential for promoting student capabilities in communication, evaluation and decision-making. The joint reflection on the research evidence and teachers' classroom experience was valuable for making teachers aware of both their own deficits and restrictions and also their interests and needs. This was an important starting point for sustainable innovation, since Huberman (1993) has already stated that any sustainable innovation in education must be bound to personal experience. In this case, it began with reflection on teachers' personal past experiences and was continuously linked to new experiences based on the newly-developed teaching approaches.

The teachers also agreed that the units showed promise for dealing with climate change in science education in a multidimensional fashion. Results from both teacher and student feedback show that this potential was beginning to be realised in the initial steps. The collaborative and cyclical design plan led – in the estimation of the teachers and educators – to highly feasible, motivating lesson plans. Both the theoretical input from the accompanying educator as well as the practical experience of the teachers contributed to the overall quality of the curriculum materials.

Within this project, two additional features were borrowed from other PAR projects in chemistry education in the past (e.g., Marks & Eilks, 2009; Eilks et al., 2010). One was the interdisciplinary approach and the other was the inclusion of partners from the informal educational domain. Compiling the results and bringing the teachers from the four groups together also clearly showed the need for

interdisciplinary approaches towards complex issues such as climate change. Nevertheless, initially working in parallel teams then networking the different viewpoints and results proved to be a good strategy. It 1) allowed each group to become clear about their experiences and interests and 2) led to lesson plans feasible for individual syllabuses in individual subjects where administrative restrictions do not allow for interdisciplinary teaching (e.g., Feierabend & Eilks, 2010). Nevertheless, the end product was a set of materials that can be combined in different ways for interdisciplinary or project-based approaches (Eilks et al. 2011b). The materials are now ready to integrate the science subjects under the inclusion of a societal point of view. This provides a basis for new teaching strategies on climate change in German science education classrooms. The inclusion of politics also helped a great deal, since this opened the project's focus and employed political pedagogies that also show promise for the area of science education. These experiences clearly support the idea that climate change as an issue requires a subject-integrated approach. This includes not just a combination of the different science teaching domains but also other relevant subjects such as politics, education, geography and other fields in the humanities. Educational policy should take care not to restrict the teaching of complex issues with more holistic approaches due to administrative barriers. This includes the overly thorough compartmentalising of education by strictly dividing it into different school subjects and their respective syllabuses. On the other hand, the inclusion of partners from the informal educational domain did not have much influence on the curriculum development process within the project. However, we can recognise its still largely untapped potential for 1) increasing levels of exchange and cooperation between (in)formal education concerning curriculum development and 2) better educational networking and fine tuning in both schools and informal education. Nevertheless, the inclusion of informal education partners gave us a second platform for the implementation of part of the materials developed.

With respect to the teachers' professional development, the issue of climate change proved to be difficult to cover. It is very uncommon for science teachers to deal with issues characterised by uncertainty, e.g., the continuous changes in scientific interpretations of available data or rapidly changing political debates, although such aspects are quite commonly dealt with by teachers of politics. Nonetheless, the science teachers felt able to cope with this challenge, thanks to the support of their diverse network of colleagues from different

domains. Based on this experience, educational policy should provide stronger support to such multidimensional networks. It can acknowledge participation in such networks, for example by compensating the teachers with downtime for the time they spend working on project activities. Unfortunately, this was not the case for most of the teachers in this project, who had to sacrifice their time on a voluntary basis. PAR proved to be a potentially beneficial structure for supporting such networking.

As part of teachers' continuous professional development our experiences with PAR support the findings of similar projects, e.g., concerning the implementation of cooperative learning in chemistry education (Eilks et al., 2010) or the socio-critical, problem-oriented approach to chemistry teaching (Marks & Eilks, 2010). The value of PAR lies in its leading to a variety of lesson plans. These plans are widely accepted by teachers as being authentic, well-tested and feasible, as we observed for the current examples of climate change lessons within this project. Furthermore, PAR also contributed to teachers' CPD in the sense that it caused changes in the teachers' knowledge base, skills and attitudes, as previously reported in Eilks (2003) and Eilks et al. (2010). The respective indications were also found within this framework.

New perspectives on PAR from this project included 1) parallel application in different teaching domains and increasing integration and 2) the inclusion of partners from informal science-related education. The first addition to the previous PAR framework in chemistry education had great value, both for the quality of the developed materials as well as for expanded opportunities for teachers' CPD. Conversely, the presence of informal educational partners did not influence the project much. Perhaps more thorough integration with this domain may uncover further potential in such cooperation.

For sustainable innovations in science education curricula and practice we can recognise the overall value of establishing research-based networks for close cooperation between educational researchers and practising teachers. Such partnerships are also operationalised in other approaches and methodologies (see Putnam & Borko, 2000). Here, they proved to us once again that both sources of information about teaching practice are invaluable. Empirically validated research results and experientially-based teacher knowledge represent the two extremes of a knowledge spectrum describing teaching and learning, and both are equally important in their own right (McIntyre, 2005).

For educational policy, this and similar projects (e.g., Eilks et al., 2010; Marks & Eilks, 2009) yield clear support for our idea that more research-oriented partnerships between curriculum developers, educational researchers, and practising teachers should be established. This would allow us to make use of all of the resources that are available for teaching practice innovation in a networked environment. PAR as a research design may help to uncover further potential for sustainable reform and implementation. These are due to the fact that teachers' beliefs, their *a priori* knowledge and personal attitudes are all involved in such reforms and are taken into account seriously by the project. This is one of the essential basics for any successful, meaningful innovation in teaching practice, as has already been discussed by Haney, Czerniak and Lumpe (1996) or Huberman (1993).

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References

Altheide, D., & Johnson, J. (1994). Criteria for Assessing Interpretative Validity in Qualitative Research. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 485-499). Newsbury Park: Sage.

Altrichter, H., & Gstettner, P. (1993). Action Research: A Closed Chapter in the History of German School Science. *Educational Action Research, 1*, 325-360.

Andersson, B., & Wallin, A. (2000). Students' Understanding of the Greenhouse Effect, Social Consequences of Reducing CO_2 Emissions and Why Ozone Layer Depletion is a Problem. *Journal of Research in Science Teaching, 37*, 1096-1111.

Bencze, L., & Hodson, D. (1999). Changing Practice By Changing Practice: Toward More Authentic Science and Science Curriculum Development. *Journal of Research in Science Teaching, 36*, 521-539.

Bodner, G., MacIsaac, D., & White, S. (1999). Action Research: Overcoming the Sports Mentality Approach to Assessment/Evaluation. *University Chemistry Education, 3*(1), 31-36.

Boyes, E., Skamp, K., & Stanisstreet, M. (2009). Australian Secondary Students' Views About Global Warming: Beliefs About Actions, and Willingness to Act. *Research in Science Education*, *39*, 661-680.

Boyes, E., & Stanisstreet, M. (1993). The Greenhouse Effect: Children's Perceptions of Causes, Consequences and Cures. *International Journal of Science Education, 15*, 531-552.

Boyes, E., & Stanisstreet, M. (1997). Children's Models of Understanding of Two Major

Global Environmental Issues (Ozone Layer and Greenhouse Effect). *Research in Science & Technological Education*, *15*, 19-28.

Eilks, I. (2000). Promoting Scientific and Technological Literacy: Teaching Biodiesel. *Science Education International, 11*(1), 16-21.

Eilks, I. (2002). Teaching 'Biodiesel': A Socio-Critical and Problem-Oriented Approach to Chemistry Teaching, and Students' First Views on It. *Chemical Education: Research and Practice in Europe, 3*, 67-75.

Eilks, I. (2003). Cooperative Curriculum Development in a Project of Participatory Action Research Within Chemical Education: Teachers' Reflections. *Science Education International, 14*(4), 41-49.

Eilks, I., Feierabend, T., Hößle, C., Höttecke, D., Menthe, J., Mrochen, M., & Oelgeklaus, H. (2011a). Bewerten Lernen und Klimawandel in vier Fächern – Erste Einblicke in das Projekt „Der Klimawandel vor Gericht". *Der Mathematische und Naturwissenschaftliche Unterricht, 64*, 7-11 and 71-76.

Eilks, I., Feierabend, T., Hößle, C., Höttecke, D., Menthe, J., Mrochen, M., & Oelgeklaus, H. (2011b). *Der Klimawandel vor Gericht – Unterrichtmaterialien für den Fachunterricht und fächerübergreifende Projekte*. Köln: Aulis-Starck *in print*.

Eilks, I., Markic, S., & Witteck, T. (2010). Collaborative Innovation of the Science Classroom by Participatory Action Research – Theory and Practice in a Project of Implementing Cooperative Learning Methods in Chemistry Education. In M. Valenčič Zuljan, & J. Vogrinc (Eds.), *Facilitating Effective Student Learning Through Teacher Research and Innovation* (pp. 77-101). Ljubljana: University of Ljubljana.

Eilks, I., & Ralle, B. (2002). Participatory Action Research in Chemical Education. In B. Ralle, & I. Eilks (Eds.), *Research in Chemical Education - What does this mean?* (pp. 87-98). Aachen: Shaker.

Ekborg, M., & Areskoug, M. (2006). How Student Teachers' Understanding of the Greenhouse Effect Develops During a Teacher Education Programme. *NorDiNa - Nordic Studies in Science Education*, *5*, 17-29.

Feierabend, T., & Eilks, I. (2010). Raising Students' Perception of the Relevance of Science Teaching and Promoting Communication and Evaluation Capabilities Using Authentic and Controversial Socio-Scientific Issues in the Framework of Climate Change. *Science Education International, 21,* 176-196.

Feierabend, T., & Eilks, I. (2011). Teaching the Societal Dimension of Chemistry Along a Socio-Critical and Problem-Oriented Lesson Plan on the Use of Bioethanol. *Journal of Chemical Education,* accepted for publication.

Feierabend, T., Jokmin, S., & Eilks, I. (2011). Chemistry Teachers' Views on Teaching 'Climate Change' – An Interview Case Study From Research-Oriented Learning in Teacher Education. *Chemistry Education Research and Practice, 11*, 85-91.

Feldman, A. (1996). Enhancing the Practice of Physics Teachers: Mechanisms for the Generation and Sharing of Knowledge and Understanding in Collaborative Action

Research. *Journal of Research in Science Teaching, 33*, 513-540.

Haney, J. J., Czerniak, C. M., & Lumpe, A. T. (1996). Teacher Beliefs and Intentions Regarding the Implementation of Science Education Reform Strands. *Journal of Research in Science Teaching, 33*, 971-993.

Hansen, P. J. K. (2010). Knowledge about the Greenhouse Effect and the Effects of the Ozone Layer Among Norwegian Pupils Finishing Compulsory Education in 1989, 1993 and 2005 - What Now? *International Journal of Science Education*, *32*, 397-419.

Hofstein, A., Eilks, I., & Bybee, R. (2011). Societal Issues and their Importance for Contemporary Science Education: A Pedagogical Justification and the State of the Art in Israel, Germany and the USA. *International Journal of Science and Mathematics Education,* published online January 2011.

Hulme, M. (2009). *Why We Disagree about Climate Change. Understanding Controversy, Inaction and Opportunity*. Cambridge: Cambridge University Press.

IPCC (2007). *Climate Change 2007 – The Physical Science Basis*. Cambridge: Cambridge University Press.

Höttecke, D., Hößle, C., Eilks, I., Menthe, J., Mrochen, M., Oelgeklaus, H., & Feierabend, T. (2010). Judgment and Decision-Making about Socio-Scientific Issues: A Fundament for a Cross-Faculty Approach Towards Learning about Climate Change. In I. Eilks, & B. Ralle (Eds.), *Contemporary Science Education* (pp. 179-192). Aachen: Shaker.

Huberman, M. (1993). Linking the Practitioner and Researcher Communities for School Improvement. *School Effectiveness and School Improvements, 4*, 1-16.

Klafki, W. (2000). The Significance of Classical Theories of Bildung for a Contemporary Concept of Allgemeinbildung. In I. Westbury, S. Hopmann, & K. Riquarts (Eds.), *Teaching as Reflective Practice. The German Didaktik Tradition* (pp. 85-107). Mahwah: Lawrence Erlbaum.

Marks, R., & Eilks, I. (2009). Promoting Scientific Literacy Using a Socio-Critical and Problem-Oriented Approach in Chemistry Education: Concept, Examples, Experiences. *International Journal of Environmental and Science Education 4*, 131-145.

Marks, R., & Eilks, I. (2010). Research-Based Development of a Lesson Plan on Shower Gels and Musk Fragrances Following a Socio-Critical and Problem-Oriented Approach to Chemistry Teaching. *Chemistry Education Research and Practice, 11*, 129-141.

Mayring, P. (2002). Qualitative Content Analysis - Research Instrument or Mode of Interpretation? In M. Kiegelmann (Ed.), *The Role of the Researcher in Qualitative Psychology* (pp. 139-148). Tübingen: Ingeborg Huber.

McIntyre, D. (2005). Bridging the Gap between Research and Practice. *Cambridge Journal of Education, 35*, 357-382.

Parke, H. M., & Coble, C. R. (1997). Teachers Designing Curriculum as Professional Development: A Model for Transformational Science Teaching. *Journal of Research in Science Teaching, 34*, 773-790.

Putnam, R. T., & Borko, H. (2000). What do New Views of Knowledge and Thinking

Have to Say about Research on Teacher Learning? *Educational Researcher, 29*, 4-15.

Rickinson, M. (2001). Learners and Learning in Environmental Education: A Critical Review of the Evidence. *Environmental Education Research, 7*, 207-316.

Sadler, T. D. (2004). Informal Reasoning Regarding Socio-Scientific Issues: A Critical Review of Research. *Journal of Research Science Teaching*, *41*, 513–536.

Whyte, W. F., Greenwood, D. J., & Lazes, P. (1989). Participatory Action Research. *The American Behavioural Scientist, 32*, 513-551.

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Using Technology to Engage Preservice Elementary Teachers in Learning about Scientific Inquiry

Loretta L. Jones,*[1] James R. MacArthur[2] and Sevil Akaygün[3]

Elementary teachers are often required to teach inquiry in their classrooms despite having had little exposure to inquiry learning themselves. In a capstone undergraduate science course preservice elementary teachers experience scientific inquiry through the completion of group projects, activities, readings and discussion, in order to develop a sense of how inquiry learning takes place. At the same time, they learn science content necessary for teacher licensure. The course exposes students to different pathways of scientific discovery and to the use of the computer both as a tool for conducting inquiry-based investigations and as a means of collecting and sharing student opinions. The students involved have many misconceptions about science and it is often difficult for them to distinguish science from pseudoscience. Computer simulations are used to help students understand that difference. In addition, a classroom response system using "clickers" is used to poll student opinions on controversial issues and to stimulate discussion.

Key words: Classroom response systems, Clickers, Elementary science education, Scientific inquiry, Technology

Introduction

The introduction of inquiry-based activities into the science curriculum resulted from a desire in the mid-twentieth century to engage students in the process of science (DeBoer, 1991). Traditionally, science had been taught as a series of facts, often poorly connected to

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one another. By engaging students in inquiry activities, the students can appreciate the thought processes of scientists and design their own experiments. Several definitions of inquiry are in use (Flick & Lederman, 2006; Minner, Levy & Century, 2009; Novak, 1964). However, a common definition in the United States is that published by the National Research Council:

> Inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (NRC, 2000, p. 14)

Most elementary teachers in the United States are now required to use inquiry activities in science lessons (Crawford, 2000; Flick & Lederman, 2006; National Research Council, 2000). In order for teachers to be successful in the use of science inquiry experiences in their own classrooms they need to experience inquiry in their own learning of science (Gitlin, Barlow, Burbank, Kauchak & Stevens, 1999; Haefner & Zembal-Saul, 2004; Howes, 2002; Jones, Buckler, Cooper & Straushein, 1997; Windschitl, 2002). However, most preservice teachers (those in teacher education programmes) have had little experience learning with inquiry (Gabel, 2003; Millar & Lubben, 1996; Newman, Abell, Hubbard, McDonald, Otaala, & Martini, 2004).

Not only is an understanding of the process of science necessary in order to teach inquiry skills, teachers also need to have sufficient understanding of science content (Luera & Otto, 2005). Preservice teachers may have misconceptions about science and may not be able to distinguish science from pseudoscience (Cochran & Jones, 1997; Nelson, 2000). Therefore, it appears that preservice teachers will be best prepared to teach science by inquiry if they have learned inquiry in a science context.

Although many teachers have to use technology in their classrooms, preservice teachers are often uncomfortable with technology and avoid using it (David & Falba, 2002). Introducing technology into science method courses and science courses for elementary teachers

has been found to encourage teachers to use technology in their own classrooms (Kim, Hannafin & Bryan, 2007). The present article reports on a capstone science inquiry course that integrates technology in meaningful ways in order to prepare teachers to lead students in inquiry-based activities and to help them distinguish science from pseudoscience. In addition, the use of technology to help students navigate the interface of science and personal beliefs is described.

Theoretical background

Inquiry-based learning is thought to provide students with authentic learning experiences that develop deeper understanding due to their constructivist nature (Flick & Lederman, 2006). In a review of 18 years of research on learning, Minner, Levy, and Century (2009) found that in the majority of the studies inquiry-based education had a positive effect on the learning of science content and on the development of inquiry skills, particularly when students were actively engaged. Because time and consistent effort is required to build competence in inquiry and productive inquiry communities (Šimenc, 2008), it may be important for teachers to have had multiple inquiry experiences before beginning their teaching careers.

One aspect of inquiry learning thought to be beneficial is the observation that different learning styles can easily be accommodated in inquiry-based learning activities (Oblinger & Oblinger, 2005). Learning styles are the various ways of learning preferred by an individual depending on his or her ability, interest or individual preferences. Fleming (1995) classified learning styles in his VARK model (Visual, Aural, Read/Write, and Kinesthetic/Tactile). In this model visual learners prefer seeing visualizations such as pictures, drawings, diagrams, or simulations when they learn. Auditory learners prefer to learn through listening to lectures, discussions, or tapes. Students who learn the best when they read or write fall into the reading/writing group. Kinesthetic/tactile learners prefer to learn through active experience and movement. Including multiple modes of learning in a lesson has the potential to maximize learning because students with different learning styles may benefit from the different representations (Sims & Sims, 1995). Inquiry-based science teaching has also been found to motivate students with different learning styles to learn science (Tuan, Chin, Tsai & Cheng, 2005).

The use of technology in the classroom has been found to enhance learning by allowing students to view visualizations of phenomena not otherwise visible (Ardac & Akaygun 2004; Kelly & Jones, 2007), to provide feedback on understanding (Jones & Smith, 1993), and to assess student learning (Ferk, Vrtacnik, Blejec & Gril, 2003). Technology can also be used to enhance inquiry learning (Edelson, Gordin & Pea, 1999). Classroom response systems using small, hand-held devices commonly known as "clickers" provide a means to enhance interactions in the classroom. These devices contain a keypad and, when used by students, emit either infrared or radiofrequency radiation signals that are collected by an instructor. The technology provides the instructor with immediate feedback on student understanding. This technology is considered by the US National Research Council to be a positive trend in education (NRC, 2000a). In science courses clickers have been used for formative assessment, to foster student collaboration, to give quizzes, to allow anonymous responses, and to take attendance (MacArthur & Jones, 2008).

Course design

To introduce preservice elementary teachers to scientific inquiry, a capstone science course in scientific inquiry was developed at the University of Northern Colorado (Fortino, 2003; Taber & Quadracci, 2006). The course was designed so that students would learn about inquiry in science classes while conducting their own group inquiry activities. Opportunities are provided for them to enhance their own inquiry skills, to develop the ability to evaluate and revise inquiry activities developed by others, and to design and present their own inquiry activities. Classes are held in a room designed for the science education of elementary teachers (Figure 1).

Figure 1. The classroom devoted to the science education of elementary teachers contains tables for group learning. Laboratory and lecture are integrated and take place in the same room. The room has an additional preparation area and a storage room for 20 laptop computers and other equipment.

At the University of Northern Colorado students who want to be licensed to teach in elementary schools major in Interdisciplinary Studies, Liberal Arts (IDLA). Students take a core set of courses and select an emphasis area, such as social studies, English or chemistry. All IDLA students must complete an elementary methods course with a six-week science portion. They must also complete three introductory science courses. Although students have several choices, most take the three courses (physical science, biology and earth science) that have been developed especially for elementary teachers (McDevitt, Troyer, Ambrosio, Heikkinen & Warren, 1995). Each of these science courses has a laboratory component that incorporates some inquiry experiences. The capstone science inquiry course is taught by science education faculty members from all of the science departments. About 150-240 students per year enroll in the course, which is taught in sections of about 30 students each.

The goals of the scientific inquiry course are to engage students in examining science as a "way of knowing," to help them to develop a sense of "how I learn by inquiry," to enhance their understanding of the interrelationships between scientific discovery and society, to develop a portfolio of inquiry teaching resources, to learn more about

using computers as a tool for conducting inquiries, and to learn science content required for licensure in the State of Colorado. The course is a science course in which students learn scientific content, rather than a methods course. However, an attempt is made to engage students in activities that they can use later in their own classrooms.

The criteria for inquiry used in the course were based on criteria recommended by the US National Academy of Sciences (National Research Council, 2000):

Students must:

- be actively involved in a hands-on activity or simulation
- formulate questions
- make and check predictions
- design and carry out investigations
- collect, analyse, and explain data
- manipulate variables
- report results and compare them with accepted facts
- develop scientific reasoning skills
- be stimulated to learn more

Various textbooks have been used in the course. Common selections are books by Derry (1999) and Bryson (2003). These books examine the nature and process of science and include science content that goes beyond what students have learned in their introductory science courses.

Students learn the science content as they work in groups to complete activities in earth science (plate tectonics, earthquakes, volcanoes, geologic time, climate), physics (energy, atomic structure, the electromagnetic spectrum), chemistry (the periodic table, chemical reactions, the nature of matter), and biology (the diversity of species, natural selection). About 60-70% of class time is spent on learner-centred activities such as hands-on paper or laboratory activities, computer activities, or group discussions. Because students are seated at tables of four or five students each, discussion normally takes place within each table group.

Each faculty member teaches the course with his or her own preferences and innovations. This paper focuses on the introduction of two types of technology-based innovations: the use of online materials and simulations to facilitate inquiry and to help students distinguish science from pseudoscience, and the use of a classroom response system to allow students to share personal views anonymously for later discussion.

Types of inquiry activities implemented

Several kinds of activities were designed for the capstone science course: laboratory activities, hands-on activities using paper or other objects, discussion and written reports, computer-based simulations, learning to use online research tools, and sharing and communication on the Blackboard course management system (http://www.blackboard.com/Markets/Higher-Education.aspx).

Each activity has inquiry components and students are asked to rate the inquiry components of each activity they complete. Initially students are asked to devise their own inquiry criteria. However, students in this type of course benefit from having detailed rubrics (Newman et al., 2004). Therefore, after comparing and discussing their ideas, students are given Table 2-6, "Essential Features of Classroom Inquiry and Their Variations," from *Inquiry and the Science Education Standards* (NRC, 2000, http://www.nap.edu/openbook.php?record_id=9596&page=29#p200165cc9960029001). This table lists five aspects of inquiry (posing questions, using scientific evidence, formulating explanations, connecting explanations to scientific knowledge, and justifying the explanations) and provides four levels of student independence, ranging from teacher-directed activity to learner-generated activity. Students are expected to be able to use the concepts in this table to rate the inquiry level of activities in examinations and in their subsequent teaching assignments. In order to prepare students for this type of authentic task the day after the students have performed each activity they are asked to discuss how well the activity fit each of the essential features and to rate the activity.

Most assessments in the course are authentic activities that teachers often perform, such as evaluating the inquiry characteristics of an activity, modifying an activity to enhance its inquiry characteristics, and designing inquiry activities. However, multiple-choice questions on the science content are also included in the examinations.

Hands-on laboratory activities vary by instructor, but in the version of the course described here they include the generation of gases and the synthesis of polymers. Other hands-on activities include the classification of rock samples and prediction of the design on the bottom of a cube from clues on the visible sides (for an example, see http://brainu.org/inquiry-cubes). After working on inquiry activities in class, students are given descriptions of science activities for elementary school children and are asked to revise the activities to enhance

their inquiry characteristics. In order to understand scientific thinking processes students model those processes. For example, they are asked to generate a periodic table of "aliens" using methods similar to those used by Mendeleev. (See http://www.gk12.ilstu.edu/New/lesson_template.asp?lessonID=402). In this activity, pictures of aliens who have landed on Earth are sorted according to characteristics such as number of fingers and body shape. One alien is missing and students must predict its appearance.

Fostering engagement in scientific inquiry with technology

Computer simulations offer many advantages for this type of instruction. Because data can be collected and analysed quickly, students can carry out many experimental trials, more closely modelling the processes of expert scientists. Although only some of the activities are simulations in which students can manipulate the variables, they provide an introduction to an aspect of science that might not be possible in a setting where experiments can be conducted only once. For example, students use sophisticated software such as *WorldWatcher* (http://www.geode.northwestern.edu/softwareWW.htm) to conduct in-depth inquiry investigations (Taber & Quadracci, 2006).

Another online activity that engages students in scientific inquiry is designing a planet (see http://astroventure.arc.nasa.gov/DAP/index.html). In this activity groups of students use a simulation to design a habitable planet for humans by selecting appropriate characteristics such as type of star, distance from the star, availability of liquid water and the producers on the planet. After they finish designing the planet students receive immediate feedback from the programme on whether their planet is habitable or not. They then examine with their group members how to improve their planet. This type of computer-based activity engages students in learning by inquiry because the simulation guides them in questioning, predicting, reasoning, thinking critically, and applying and evaluating their understandings.

In general, most classroom science activities emphasise visual, auditory, and reading/writing aspects, rather than kinaesthetic/tactile aspects. However, access to materials on the Internet has facilitated the introduction of activities that appeal to kinaesthetic/tactile learners. One example is the activity "Kinaesthetic Astronomy" (see http://education.sdsc.edu/teachertech/downloads/kin_astronomy.pdf).

In Kinaesthetic Astronomy students experience basic astronomical concepts such as the meaning of day, year and season through bodily movements and positions such as rotating, spinning and walking. This activity helps students improve their reasoning skills as they physically imitate the motions of the Earth and moon and connect their observations with these motions.

The Internet plays an important role in the course. Blackboard is used for online quizzes, discussion, resources, surveys and web links. Students also learn to access the National Science Digital Library (http://www.dlese.org) to search for science lessons with appropriate levels of inquiry characteristics.

The Internet is also used by students to complete assignments on the interface of science and personal beliefs. One example is an activity that helps students to distinguish science from pseudoscience. Many of the students in this course have some belief in pseudoscience. This activity presents them with what appear to be on-line occult happenings that they must find a way to explain. Extrasensory perception (ESP) was selected as an example of how easy it is to be fooled by pseudoscience. Initially, students visit a website that claims it can read their minds (for example, see http://sprott.physics.wisc.edu/pickover/esp.html), and develop in groups an explanation of how the ESP program tricks the viewer. They then design experiments to test their explanation. This activity helps students to face personal beliefs that may conflict with scientific knowledge.

Students learn to use the computer as a tool. Because communicating ideas is an important inquiry skill, each student group must research and prepare a Powerpoint presentation on a scientific discovery of their choice and present it along with a related hands-on activity that they have devised or that they found on the Internet. Peer review is used to give students practice in the assessment of presentations and activities.

Fostering engagement with a classroom response system

When a classroom response system utilizing clickers to solicit student input and feedback is used in science courses, typically groups of students are given a problem to solve. The instructor then projects a histogram of the responses, after which students can discuss the findings and revise their answers (Fagen, Crouch & Mazur, 2002). In the science inquiry capstone course clickers were used in a different way.

The concepts covered in the course often do not have answers that can be scored objectively. Instead, the scoring of student responses is based more on their ability to justify a response than the response itself. Clickers were introduced into the scientific inquiry capstone course to facilitate the following three processes:

- To rate the inquiry aspects of an activity.
- For anonymous polling of opinions on controversial topics.
- To review for the final examination.

Rating the inquiry aspects of an activity

When students rate an activity that they have completed the previous day they use clickers to vote on their rating of each aspect of inquiry, as described previously. After the histogram for each aspect is displayed, volunteers who have made each of the more popular ratings are called upon to defend their choices, leading to further discussion. Without clickers the discussions took place in individual groups. Although the groups reported their ratings, it was difficult to determine the majority opinions.

Anonymous polling of opinions on controversial topics

Because the capstone course deals with societal issues, the interface of science and religion and topics such as evolution, which are not accepted by some students, clickers allow students to share their true opinions without fear of peer rejection or being "punished" by the instructor for a dissenting opinion. Students are asked to respond to questions such as those in Figure 2. Following the voting the class discusses the responses.

Derry says "Science attempts to bring coherence to our experiences, whereas religion attempts to infuse our experiences with meaning."	
	Do you think this is a fair statement?
a)	Yes, I think this statement is fair to both science and religion.
b)	No, I think this statement overstates the importance of science and understates the importance of religion.
c)	No, I think this statement overstates the importance of religion and understates the importance of science.
d)	I am not sure what this statement means.
e)	Other (please be prepared to explain.)

Figure 2. Sample clicker question on a topic from the assigned reading.

Clickers are particularly useful when students are learning about pseudoscience and the belief in the intelligent design of the universe held by some. This application is felt to be important because the students will be classroom teachers and may have in their class students whose parents believe in intelligent design or aspects of pseudoscience.

Reviewing for the final examination

In the terms during which these innovations were introduced, 20% of the final examination consisted of 25 multiple choice questions, some of which had more than one correct answer. The mid-term examination students had taken did not contain this type of question. Therefore, in order to prepare students for the final examination one day of the course was set aside as a review day, in which a large portion of the class time was spent using clickers to answer a series of eight multiple choice questions similar in nature to those that might appear on the final exam. These questions covered a wide variety of material discussed in the course: activities performed, significant scientific discoveries, scientific concepts such as experimental design and proportions, and aspects of scientific inquiry. Students voted individually on their selection for each question, followed by a classroom discussion.

Course evaluation

The course as a whole was evaluated by the 29 students in one class. The students were provided two opportunities to evaluate the course: an anonymous online survey midway through the term and an anonymous open-ended written survey to evaluate the activities, course materials and instructional approaches at the end of the term. In addition, the authors of this paper (two of whom were instructors and one who served as a faculty observer and attended the majority of the class sessions) recorded their experiences with clickers and identified any difficulties that had arisen with their usage.

Evaluation results

Reactions to the activities, course materials, and instructional approaches

Throughout the course students had experienced inquiry via various activities, discussions, readings, and assignments. The open-ended course survey completed at the end of the term showed that when students were asked what aspect of the course they enjoyed the most, they identified the nature of inquiry in their group work (33%) activities (29%), hands-on experiments (15%), computer activities (15%), inquiry (4%), and readings from Derry (4%). In other words, they said they enjoyed inquiry in different ways. Twenty-two percent of the preservice elementary teachers also voluntarily mentioned that they would consider implementing some of these activities in their own teaching.

Some of the student responses to the question, "What aspects of this course did you enjoy the most?" are given below.

- "I enjoyed the scientific inquiry."
- "I really like being able to work in groups and share information as a group. I like how science is taught in a simple way that is understandable."
- "I enjoyed all of the activities we did; they will be very helpful in my future classroom"
- "I really enjoyed all of the activities and resources of sites that were interactive for children. I feel as though I will refer to them when I become a teacher and that they will be useful when I teach anything science related!"
- "I enjoyed the online inquiry activities the most because they were hands-on".

- "The aspects that I enjoyed the most were the computer-based activities. They were fun, interactive, and I look forward to integrating them into my future classroom".

When the students were asked which aspects of the course they found the most useful, they mentioned the in-class activities (35%), using the inquiry table for evaluating the inquiry nature of the activities (19%), modifying activities to be more inquiry oriented (15%), learning inquiry, the computer/online activities (8%), the experiments (4%), the readings (4%), and learning the National Science Education Standards (4%). It should be noted that these comments were generated by the students. Therefore, although the percentages are small, they represent spontaneous comments from students. Overall, students made positive comments on each question.

Some of the student responses to the question, "What aspects of this course do you find the most useful?" include the following:

- "The inquiry in this course was very important and useful for me because I hadn't known anything about it until I took this course. I feel like it will help me make decisions about my lesson plans when I become an elementary teacher."
- "I think knowing and understanding scientific inquiry will be very useful for me as a future teacher."
- "I thought the activities that we could use in an elementary school setting (like the activity with the aliens that we had to categorise) were most helpful."
- "The inquiry table was helpful/useful."
- "The ideas for how to make activities more student oriented and less teacher oriented. In some activities students need to have more interaction so they will be able to learn better."
- "The aspect that I found most useful is making science activities more inquiry based."

Reactions to the use of clickers

Students provided positive feedback regarding the use of technology in general and clickers specifically, in both the online survey and the in-class written evaluation, even though there were no questions specifically about technology on either evaluation. One of the questions in the online survey was: "I'd like to have a more active class discussion in lectures. Do you have any suggestions on how to facilitate this?" A student response to this question was: "I think that discussion

with the groups is good. Like when we use clickers and we have to answer the questions as a group." When asked at the end-of-term evaluation to provide an example of something the instructor did well, several students mentioned the use of technology, and one student said "I liked how the instructor used clickers."

Instructor reactions to the use of clickers

The clickers were found to be especially useful in eliciting opinions on controversial topics from students. The anonymity of clicker input allowed students to express themselves freely. For example, in a lesson on evolution clickers were used to discover that some students did not believe in evolution. Following the lesson these students retained their beliefs, but because they had been allowed to express their ideas, they did not feel it necessary to continue arguing their points. However, clickers were found to be less useful for activities such as examination review, which could be easily conducted without them. The use of clickers was found to have some drawbacks. It takes class time to implement the technology, students may have difficulty adjusting to the unfamiliar interaction, the technology may not work properly, the format of questions is usually limited to multiple-choice, and it may take additional time to adjust lesson plans to the technology. Despite these difficulties, the technology was found to be valuable and worth using again.

Conclusions

Throughout the course students experienced inquiry via various activities, projects, discussions, readings, and assignments. The students found the inquiry-based activities to be both useful and enjoyable. The observation that students responded positively to each question of the final course survey suggests that these preservice elementary teachers felt that they learned, appreciated and evaluated inquiry in the course activities, and wanted to include inquiry in their lesson plans when they start teaching.

It was possible to expand the inquiry experience through the use of technology. Computers were used to engage students in simulated inquiry experiences not otherwise possible in a classroom. Students also learned how to use the Internet as a tool for designing their own inquiry learning experiences.

The use of clickers allowed instructors to introduce more

activities consistent with the theme of student empowerment. Others have concluded that student empowerment is an essential feature of successfully implementing clickers into classrooms (Trees & Jackson, 2007). For example, students used clickers to rate the inquiry aspects of activities. The ratings themselves were not as critical as the justifications for their selection, which led the students into a discussion regarding their choices. Perhaps even more empowering was the use of clickers to poll students on their opinions regarding the interaction between science and religion. Students were allowed to express their feelings completely anonymously, as instructors had no record of which clicker each student was using. The use of clickers also allowed instructors to clarify some points of confusion with the reading, as students often chose "I am not sure what this statement means" when provided with the opportunity to state their opinion on an excerpt from the text.

The implementation of clickers that was found to be the least useful was in the final examination review session. This observation is consistent with the work of others, who have found that the overuse of clickers may have poor results if the right niche is not found (Draper & Brown, 2004). The examination reviews conducted may not have been a good application of clickers. Although clickers are useful for formative assessment in very large courses, where they help to improve student interactions, other methods are available both for formative assessment and for catalyzing student cooperation in smaller courses such as this. The application for which the clickers were thought to be most useful was in the discussion of controversial issues, as students could propose minority opinions without being singled out.

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References

Ardac, D., & Akaygün, S. (2004). Effectiveness of multimedia-based instruction that emphasizes molecular representations on students' understanding of chemical change. *Journal of Research in Science Teaching, 41*, 317-337.

Bryson, B. (2003). *A Short History of Nearly Everything.* London: Doubleday.

Cochran, K., & Jones, L. L. (1997). The Subject Matter Knowledge of Preservice Science Teachers. In B. Fraser, & K. Tobin (Eds.), *International Handbook of Science Education* (pp. 707-718). Kluwer: The Netherlands, 1998.

Crawford, B. A. (2000). Embracing the essence of inquiry: New roles for science teachers. *Journal of Research in Science Teaching, 37*(9), 916-937.

Davis, K. S., & Falba, C. J. (2002). Integrating technology in elementary preservice teacher education: Orchestrating scientific inquiry in meaningful ways. *Journal of Science Teacher Education, 13*(4), 303-329.

DeBoer, George E. (1991). *A History of Ideas in Science Education: Implications for Practice.* New York: Teachers College Press.

Derry, G. N. (1999). *What Science Is and How It Works.* Princeton, New Jersey: Princeton University Press.

Draper, S.W., & Brown, M.I. (2004). Increased interactivity in lectures using an electronic voting system. *Journal of Computer Assisted Learning, 20*, 81–94.

Edelson, D. C., Gordin, D. N., & Pea, R. D. (1999). Addressing the challenges of inquiry-based learning through technology and curriculum design. *The Journal of the Learning Sciences, 8*(3&4), 391-450.

Fagen, A., Crouch, C., & Mazur, E. (2002). Peer instruction: results from a range of classrooms. *Physics Teacher, 40*, 206-209.

Ferk, V., Vrtacnik, M., Blejec, A., & Gril, A. (2003). Students' understanding of molecular structure representations. International *Journal of Science Education, 25*(10), 1227-1245.

Fleming, N.D., (1995). I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom. In A. Zelmer (Ed.), *Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA),HERDSA, Volume 18* (pp. 308 – 313).

Flick, L. B., & Lederman, N. G. (2006). *Scientific Inquiry and the Nature of Science: Implications for Teaching, Learning and Teacher Education.* Netherlands: Springer.

Fortino, C. (2003). *From historical stories to hands-on labs.* Colorado Science Convention, Denver, CO, Nov. 21.

Gabel, D. (2003). Enhancing the conceptual understanding of science. *Educational HORIZONS, 81*(2), 70-76.

Gitlin, A., Barlow, L., Burbank, M. D., Kauchak, D., & Stevens, T. (1999). Pre-service teachers' thinking on research: implications for inquiry oriented teacher education. *Teaching and Teacher Education, 15*, 753-769.

Haefner, L. A., & Zembal-Saul, C. (2004). Learning by doing? Prospective elementary

teachers' developing understandings of scientific inquiry and science teaching and learning. *International Journal of Science Education, 26*(13), 1653-1674.

Howes, E. V. (2002). Learning to teach science for all in the elementary grades: What do preservice teachers bring? *Journal of Research in Science Teaching, 39*(9), 845-869.

Interactive Clickers can increase student response. (2006). *Curriculum Review, 45*(4).

Jones, L. L., Buckler, H., Cooper, N., & Straushein, B. (1997). Preparing Preservice Chemistry Teachers for Constructivist Classrooms through Use of Authentic Activities. *J. Chemical Education*, *74*, 787-788.

Jones, L. L., & Smith, S. G. (1993). Multimedia Technology: A Catalyst for Change in Chemical Education. *Pure and Applied Chemistry*, *65*, 245-249.

Kelly, R. M., & Jones, L. L. (2007). Exploring how different features of animations of sodium chloride dissolving affect students' explanations. *Journal of Science Education and Technology, 16*(5), 413-429.

Kim, M. C., Hannafin, M. J., & Bryan, L. A. (2007). Technology-enhanced inquiry tools in science education: An emerging pedagogical framework for classroom practice. *Science Education, 91*(6), 1010-1030.

Luera, G. R., & Otto, C. A. (2005). Development and evaluation of an inquiry-based elementary science teacher education program reflecting current reform movements. *Journal of Science Teacher Education, 16*(3), 241-258.

MacArthur, J. R., & Jones, L. L. (2008). A review of literature reports of clickers applicable to college chemistry classrooms. *Chemistry Education Research and Practice*, *9*(3), 187-195.

McDevitt, T. M., Troyer, R., Ambrosio, A. L., Heikkinen, H. W., & Warren, E. (1995). Evaluating prospective elementary teachers' understanding of science and mathematics in a model pre-service program. *Journal of Research in Science Teaching*, *32*(7), 749-775.

Millar, R., & Lubben, F. (1996), Knowledge and action: Students' understanding of the procedures of scientific enquiry. In G. Welfor, J. Osborne, & P. Scott (Eds.), *Research in Science Education in Europe* (pp. 191-199). London: The Falmer Press.

Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction—what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching, 47*(4), 474-496.

National Research Council (2000). *Inquiry and the Science Education Standards,* National Research Council, 2000, Washington: National Academy Press. Retreived April, 19, 2011 from http://books.nap.edu/html/inquiry_addendum/.

Nelson, M. (2000). A case of preservice elementary teachers exploring, retelling, and reframing. *Research in Science Education, 30*(4), 417-433.

Newman, W. J., Abell, S. K., Hubbard, P. D., McDonald, J., Otaala, J., & Martini, M. (2004). Dilemmas of teaching inquiry in elementary science methods. *Journal of Science Teacher Education, 15*(4), 257-279.

Novak, A. (1964). Scientific inquiry. *Bioscience, 14,* 25-28.

Oblinger, D. G., & Oblinger, J. L. (Eds.) (2005). *Educating the Net Generation*, Educause.

Retreived April, 19, 2011, from http://www.educause.edu/educatingthenetgen.

Sims, R. R., & Sims, S. J. (1995). *The Importance of Learning Styles*. Westport, CT: Greenwood Press.

Šimenc, M. (2008). The status of the subject in the classroom community of inquiry. *Theory and Research in Education, 6*(3), 323-336.

Taber, M. R., & Quadracci, K. (2006). Building geosciences vocabularies using a data visualization tool. In C. Manduca, & D. Mogk (Eds.), *Earth and Mind: How Geologists Think and Learn about the Earth*, Boulder. Colorado: The Geological Society of America.

Trees, A. R., & Jackson, M. H. (2007). The learning environment in clicker classrooms: student processes of learning and involvement in large university-level courses using student response systems. *Learning Media and Technology, 32,* 21-40.

Tuan, H-L., Chin, C-C., Tsai, C-C., & Cheng, S-F. (2005). Investigating the effectiveness of inquiry instruction on the motivation of different learning styles students. *International Journal of Science and Mathematics Education, 3*(4), 541-566.

Windschitl, M. (2002). Inquiry projects in science teacher education: What can investigative experiences reveal about teacher thinking and eventual classroom practice? *Science Teacher Education,* 112-143.

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Encouraging Teachers' and Students' Innovation with the Support of Teacher Learning Communities

Leonor Margalef García[1]

The purpose of this paper is to share knowledge generated through the implementation of "Teaching Innovation Teams" as a strategy for teachers' professional development and innovation at the University of Alcala (Spain). We analyse the contributions of this strategy to the facilitation of curriculum innovation in higher education and reflect on some of the achievements and results of the activities carried out by these teams, identifying the dilemmas and difficulties that teachers experienced and that hinder the development of curriculum innovations. Finally, we outline some educational contributions of Teaching Innovation Teams understood as a collaborative and formative strategy to facilitate educational change.

Key words: Collaborative learning, Higher education, Professional development, Teacher learning communities, Training teachers

Introduction

For a decade, Spanish universities have been involved in a process of change and adaptation to the European Higher Education Area. This process has provided an opportunity for review and reflection, from the purposes and functions of the university as an institution to the ways of teaching and learning.

"Innovation" made its official entry into universities and appeared in a variety of fields: *institutional*, specific vice-chancellorships and offices were, for example, created to address this task; *educational*, a multitude of courses, seminars and conferences were given with the sole theme of teaching innovation; *didactic*, learning strategies began

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to be implemented and debates were held on the updating of teaching methodologies; *evaluative*, new indicators of educational innovation were incorporated in order to assess teachers; and *financial*, various calls were organised to finance teaching innovation projects.

With so much interest and dissemination surrounding educational innovation at universities it is logical that various questions would arise: What do people think innovation is? What has actually been innovated? How and with what strategies? What results have been obtained and what has been the impact on educational practices? Of course, answering these questions would require a thorough investigation and that is not the purpose of this paper. What we want to show is an alternative way to understand the processes of curriculum innovation from its most profound framework, i.e., from a cultural change in the university community, a change in mentality that leads to a transformation in teaching practices.

To this end, we present the experience that we conducted at the University of Alcala (UAH) in order to foster the implementation of curriculum innovation processes in university classrooms. In this paper, we will describe and analyse the strategy that the University Teacher Training Office uses to train teachers in order to create a teaching innovation culture. This culture is also upheld by the creation of learning communities in order to support not only the professional development of our teachers but also the improvement of teaching-learning processes. We have called this strategy "Teaching Innovation Teams". These teams have become an opportunity for teachers to come together and plan, design and assess curriculum innovations on their own practices.

Innovation and learning communities for professional development

The theoretical framework that supports our work is based on two fundamental pillars: teaching innovation and professional development through learning communities.

With regard to the first, teaching innovation, we have used the meaning of innovation built from the model of practice and enquiry as stance, supported by Cochran, Smith and Lytle (2003); Hargreaves (2000); Randi and Corno (2000); Könings et al. (2007); Goodnough et al. (2009) and other prior studies gathered in Margalef and Álvarez (2005); Margalef, Canabal and Iborra (2006); and Margalef and Pareja (2008).

Based on these, we understand that innovation:

- Means an idea perceived as new by someone, and in turn includes the acceptance of this novelty.
- Involves a change that seeks to improve an educational practice.
- Is a deliberate and planned effort aimed at the qualitative improvement of educational processes.
- Entails learning for those who become actively involved in the innovation process.
- Is related to financial, social and ideological interests that influence the entire innovation process.
- Is an intermittent process that signifies first-person involvement, i.e., it is begun individually but in collaborative relationship with others who are part of the trainee community in order to carry out a transformation from within.
- Questions the beliefs and conceptions related to teaching and learning.
- Is a process that takes time and requires bringing together knowledge, action, risk and responsibility.

As stated by Kushner (2002, p. 198), "innovations are acts of meaning, but there is no reason to imagine that the meanings are stable across individual lives". For this reason, we understand that these meanings must be built and rebuilt with the help of other professionals who comprise a teachers community. We tend to think of innovations in a proactive manner always leading to a transformative action, but this means understanding innovation only from the perspective of the person who proposes it and not of the individuals "touched" by the programme, regardless of whether they are professors or students. For many of these people, innovations are things that usually occur unexpectedly. For this author, these people need a process in which experience and ideas, dissatisfaction and ways of thinking, failures and learning, comprise a foundation. Experience is a test and preparation for entering into a process of change. From there is where we need to round off the perspective of innovation with that of professional development, understood as an area of the experiential learning of the participants themselves.

Könings, Brand and Merriënboer (2006, p. 995), state the following conditions that are necessary in order for innovation to be effective in practice:

- An innovative educational design should offer teachers a great deal of guidance on how to implement it in practice, as our results indicate that teachers otherwise tend to implement the innovation in accordance with their own approaches to teaching, which are not always in line with the intended design.
- Therefore, a second practical implication is that cooperation between educational designers and teachers should be promoted and become common practice. Because teachers experience problems in the feasibility of the design, they themselves adapt the design to a practical form. These feasibility problems provide important feedback for designers and a starting point for cooperating with teachers more closely in order to develop a more workable design.
- The principles of participatory design can give practical guidance for this cooperation. With more intensive cooperation between designers and teachers the scope of the innovative design can be enhanced, as it makes it easier for teachers to teach according to the design rather than according to their own approaches to teaching.

In this regard, we are aware that the institutional context that is favourable for innovation in universities does not include ordering or controlling; we know that the subjects participating in the innovation processes must become involved. For this reason, it is important to clearly know the reasons for the changes and their meaning; in other words, the *why* of innovation. Facilitating curriculum innovation processes in which the students play the lead role in their learning is not a question of decrees or external regulations; designing and developing environments of independent and heteronomous learning and of critical and reflective learning requires the creation of appropriate situations that provide students with an opportunity to develop these types of learning (Brockbank & McGill, 2002). Teachers need to rebuild their practices in order to design these learning situations.

One way to contribute to the rebuilding of customary teaching practices is to provide training and support to teachers so that, based on processes for building individual and collective knowledge, they can transform their teaching. Hannan and Silver (2005) document various studies, the results of which have shown that university

teachers commit to innovation despite knowing that it entails more work and dedication. Although they do not do so to gain a promotion they do appreciate receiving institutional support and incentives. Therefore, the Training Programme Proposal, through its goals, structure and characteristics, is a way of bringing this incentive, recognition and support for innovation to light.

The second pillar of our theoretical framework is the professional development of teachers through learning communities. Our understanding of a community of learning and enquiry is in line with the definition provided by Christie et al. (2008, p. 264): "a group of people who work together with a shared purpose which entails some collaborative attempt to explore issues or answer questions and hence potentially create new knowledge or understanding in a given domain for anyone seeking to establish a collaborative community of enquiry in the context of educational research".

For Dooner et al. (2008, p. 565), we must take one step further, as they state that "a learning community is a group that act on an ongoing basis to develop their knowledge of a common interest or passion by sharing individual resources and by engaging in critical dialogue. Thus, if members' relationships are built on trust, the forthright nature of the group's practice can generate honest interactions, challenging questions, and constructive feedback, all of which are essential for intellectual growth to occur".

Taking all of the above into account in order to propose Teaching Innovation Teams, we have relied on the research and contributions of action research and the research conducted by the teachers themselves as a way of ensuring a change in the traditional *habitus* and the search for a *reflective habitus* that leads to innovation from "within" (Cochran-Smith & Lytle, 2003; Lieberman, 2003; Ponte, 2002).

This is not a simple task. Training and support are required in order to be able to carry out a reflection on practice that involves an exercise of self-reflection (Gruskha, McLeold & Reynolds, 2005).

With the processes of innovation through learning communities, a contribution is made to the development of abilities for reflection on the professional task. Teachers are aware of their initial situation, of what they do, why they do it and what they can do and improve. As indicated by Harrison, Lawson and Wortley (2005), it has to do with the teachers understanding not what they can change in others but what they can change in themselves.

Thus we have chosen some of the principles that support a reflective practice in order to guide our formative actions, as contributed by Kraft (2002):

- Understanding the actual practice and the different variables involved that are linked with an impact on teaching-learning processes.
- Internal change, from within and with the actual involvement of teachers.
- Taking into account beliefs.
- Making beliefs and conceptions explicit.
- A critical view of the "use of power".

As suggested by McLaughlin and Talbert (2006), the development of Teacher Learning Communities involves *collaborative work* or a project that fosters the *collaboration* of a group of teachers who share a mission or commitment to improving their teaching practices. This project usually arises from an interest in changing their practices. The development of Teacher Learning Communities depends on:

- How the collaborative work of the teachers within the community is designed, guided and accompanied.
- The extent to which a context is created that allows the teachers to *learn from their own practice*.

It also signifies the *ability of the group to create and use knowledge and tools* in order to improve their teaching practices.

In the Teaching Innovation Teams, as we describe below, we have gone from individual self-reflection processes to a shared reflection through dialogue, observation and feedback, from the most contemplative reflection to action and a commitment to improving and transforming practices. The intention is to create a context that allows teachers to learn their practice and improve it through the development of innovations.

Teaching innovation teams as a professional development strategy

The University Teacher Training Office of the University of Alcala has incorporated the creation of Teaching Innovation Teams as a formative action that supports teaching innovation. These groups are comprised of at least three teachers from our University with the goal

of implementing innovative experiences in their teaching practices. Although our University has been carrying out some activities within the framework of calls for innovation projects, priority is given to providing teaching activities with more drive, systematisation and continuity. It is important to consolidate the activities and lines of work, to go beyond the scope of isolated or sporadic actions and give greater recognition to teachers involved in improving their teaching practice.

The creation of Teaching Innovation Teams is aimed at achieving the following objectives:

- Encouraging teachers to actively participate in stable teams that implement actions related to innovation and the updating of educational methodologies
- Contributing to the creation of a collaborative culture of continuous training for teachers' professional development
- Creating an actual impact on the teaching practice at UAH and contributing to an improvement in teaching quality
- Providing spaces and channels for reflection, for questioning and rethinking practices and proposing new ones based on theoretical and practical knowledge
- Granting greater recognition, outreach and dissemination to educational innovation actions as well as to the teachers involved.

At this time, 29 groups are officially registered, comprised of 220 teachers who belong to different teaching categories (from assistants to professors) and a wide variety of disciplines. The groups have different characteristics, needs and courses of action. There are groups of teachers with the same degrees, for example, physiotherapy, law or English language and culture, while other groups are comprised of teachers with different degrees but who belong to the same faculty, as in the case of history, humanities and philosophy. There are also interdisciplinary groups in which the teachers belong to different departments, faculties and even campuses. I think that it is from these groups that we can learn the most, with a view to making progress with proposals of cross-cutting skills and content, as well as to introducing common credits to various branches of knowledge or within the same branch, in such a way that they promote greater integration and a more interdisciplinary approach.

Each group is assigned a *facilitator for the teachers' learning processes*. The facilitator's functions are related to detecting formative

needs, monitoring and supporting the group's activities, and encouraging and contributing to professional development through the knowledge generated within each group and its dissemination in order to contribute to public knowledge (Brockbanck & McGill, 2002; Cochran Smith & Lytle, 2003; McLaughlin & Talbert, 2006).

The group and the facilitator jointly draw up a work plan for the support and monitoring provided, as well as for the enquiry into and learning of the innovative practice itself. The goal is to go beyond experiential knowledge with a view to creating spaces of reflection that make it possible to review and question cases, enquire into the reasons for what is being done, critically review the didactic strategies being carried out and discover the theories and models that lie behind their practices. Through this collaborative work, the teachers can debate, disagree, enquire and explore different ways of doing things, while making comparisons with other individuals who research the same topics in order to generate didactic knowledge (Margalef, Canabal & Iborra, 2006).

We agree with Christie et al. (2008) that the factors for creating a learning community that fosters innovation must be based on:

1. Dialogue and participation: a community depends on its members' opportunities to engage in dialogue and other modes of participation.
2. Relationships: participation in a community is sustained through the quality of its relationships.
3. Perspectives and assumptions underpin the relationships of a community and may offer insights into the dynamics and operation of the community.
4. Structure and context: how a community operates is governed by its structure and context, including the extent to which its structure is imposed or constrained either internally or externally.
5. Climate: as a community develops, a climate for its operation also emerges, involving aspects such as tone, environment, and potential conflict.
6. Purpose: the purpose of an enquiry will influence this climate and there may be a need to accommodate or harmonise a multiplicity of purposes arising from the complex interrelationships, perspectives, and assumptions involved.
7. Control: a key issue for all communities is control, in relation to who has access to the community, to resources, constraints, and power within it.

All of the above are determining factors for the success of the Teaching Innovation Teams as agents of innovation in university teaching.

The power of the processes as learning tools

With a view to investigating the processes carried out by the Teaching Innovation Teams as mediators of the transformation and improvement of teaching, the TET (Train, Enquire, Transform) Research Group has spent two years conducting research that makes it possible for us to generate knowledge on these processes.

The research questions have focused on the following:

- What stages or phases do the Innovation Groups go through?
- What factors favour the Group's involvement in the innovation process in university teaching?
- What is the facilitator's role? What strategies are used to encourage reflection by the Group and foster their development?
- What are the relationships established amongst the Group members and between the Group and the facilitator?

A Case Study: the innovation process

Given the Groups' diversity, we have conducted a case study comprised of six Teaching Innovation Teams in order to further analyse the factors and limitations of the learning communities for professional development and innovation.

Four of the six groups are comprised of teachers from the same knowledge area: two from health sciences, one from social sciences and one from engineering. The two interdisciplinary groups are comprised of teachers from different branches of knowledge.

The facilitators of these groups acted as external researchers or critical friends, in accordance with the action research model. The following tools were used to gather information: participant observation, journals to which we had access, in-depth interviews with the coordinators of the Innovation Groups, discussion groups, and facilitator seminars that were a basis for the triangulation of data and theoretical triangulation.

Content analysis was carried out to analyse and interpret the data, while further study of the various dimensions was undertaken on two different levels: vertical and horizontal. The horizontal analysis

was carried out within each dimension and category of analysis, based on each Innovation Group selected in the Case Study in order to not lose any information. In the vertical analysis, the data from all of the cases was triangulated and the material was identified as a whole for the presentation of the results in an integrated manner.

The categorisation procedure was a two-fold process: *inductive* ('bottom-up'), creating new emerging categories that arose from the 'text' in order to be part of the category system, and *deductive* ('top-down'), in the sense of using previously created categories, especially based on the categories used in the interviews. The categories created through the inductive process facilitated the understanding, clarification, comparison and verification of the categories created prior to the commencement of analysis. Furthermore, they facilitated a greater understanding of the analysed phenomenon.

We are currently finalising the analysis phase and data interpretation, but we have some preliminary results that are shared in this paper.

Stages or phases that the Innovation Groups go through

From the beginning, the Groups have formed according to various expectations and motivations. There is a common denominator that leads us to conclude that the teachers who have participated in the innovation groups are all interested in implementing innovations in their classrooms or in the planning of their curriculum. As indicated by Könings et al. (2007, p. 986), a teacher's willingness to learn is a crucial factor for implementing educational innovations.

Nevertheless, we have noted diversity in the rates of development of each group, as well as of the members who comprise the groups. We were able to verify that there are two different types of behaviour that affect, in an uneven manner, certain issues related to the implementation of innovations. Of the types or models indicated by Van Ekelen and cited by Könings et al. (2007, p. 986), we have identified two in our groups. There are "teachers who wonder how to learn and want to improve their teaching practices but do not know how to accomplish this. They are mostly critical of their own role". But we have also found that there is a group of teachers, perhaps the minority, "who are eager to learn, want to improve their performance and undertake action in order to learn. They are alert to classroom process, have an open mind for others and are critical towards their own role".

This manner of acting and its diversity in the responses is detected in the content of the proposed innovations, in the relationships that are established with colleagues and students, in opening up to new processes and in the attitude towards reflection on and criticism of their own practice.

To analyse this process and the differences in each group we took the development stages indicated by McLaughlin and Talbert (2006) and summarised them in the following table in order to understand the evolution of our groups.

Table 1. Developmental levels of enquiry-based reform

Novice	Intermediate	Advanced
- Constructing a teacher community - Developing systems to manage reform work - Creating a focused effort to guide school reform efforts - Discovering the value of data and how to use it - Experimenting with enquiry and creating procedures	- Developing a norm of questioning - Beginning to develope a shared language - Broadening teachers' leadership roles in reform - Clarifying vision; developing work plans to enact vision. - Managing data so that it can be used in better ways - Focusing on teaching and learning	- Becoming a learning community focused on improved practice and shared accountability - Establishing ownership of reform work among most of the faculty - Establishing coherence - Managing external pressures - Connecting whole-school, subunit, and classroom enquiry focus and practice.

Source: McLaughlin and Talbert, 2006, p. 36

There are groups that we can identify in each of these stages. It is important to consider that there is no correlation between how long the groups have existed or when they were formed and their level of maturity. We have identified various determining factors that allow the groups to progress from one level to another. These are related to the characteristics indicated by the authors.

Due to limited space, we have only cited three excerpts from the notes taken on the three innovation groups that belong to these levels:

- Example of Innovation Group D, Novice Level

  "It is still not very clear to this group what their task is. They are more focused on creating finished products, but have not yet been able to focus on the teaching and learning in their own practices.

Nonetheless, they are satisfied because they are creating a climate of collaboration, because they share an interest in improving their practices. They are still very focused on organisational tasks and on seeking greater clarity and coherence with regard to a common objective." (Journal from Facilitator B)

- Example of Innovation Group H, Intermediate Level
  "*They have found a common theme around which to work in a shared practice. They themselves are carrying out experiential learning as they design an interdisciplinary seminar in which they put their own manner of understanding teaching and learning into play. As facilitator, I have been able to go beyond the task-related organisational functions. We have gone from strong dependence to greater independence, especially through the peer coaching work that some of the members are carrying out.*" (Journal from Facilitator L)
- Example of Innovation Group F, Advanced Level
  "*This is a highly motivated group. It has a very rich prior history of experience and collaborative work. They have been working together for a very long time. One factor is that they are building a shared conception of learning. Despite their individual differences, they know exactly what the reasons for their innovation are. Another important factor is that they have actively participated in the Teacher Training Programme. Also, as facilitator, I have developed various formative strategies for integrating theory and practice: readings, debates, seminars with experts in subjects that are of interest, discussion groups.*" (Journal from Facilitator A)

Based on the interpretation of the data, some of the more noteworthy factors that help the Innovation Groups progress from one maturity level to another are:

- **Cohesion:** the groups that appear to be more closely-knit are those in which the members had prior relationships with one another, relationships that were established before they came together as groups, such as collaborative work previously carried out as innovation projects. Another dimension that contributes to greater cohesion is related to the ways in which teaching and learning are perceived. When there are similarities in ideologies or in the ways in which to

address teaching practice the groups advance more quickly through the developmental levels. The level of commitment to implementing transformations in their classes contributes to the group as whole becoming stronger as a learning community.

- **Interaction between the group members** strengthens the sense of belonging and the climate of trust. As a result, they can focus on the processes to transform their practices. "Practice must be a point of departure for developing a profession with confidence and pride and providing a common basis for change and development". (Postholm, 2008, p. 1727). This is also highlighted as a basic factor in the studies conducted by Zwart et al. (2008).
- The **leadership of some of the group members**, generally the coordinator or the head person who has configured the groups.
- The **clarity and degree of achieving the group's purposes and objectives** with regard to innovation. When the groups know exactly what their proposed objectives are and share their immediate problems they gradually bring focus to their innovation proposals, using reflection on their own practice and integrating the principles and procedures of action. In this way, they progress more quickly towards the advanced maturity stage, as indicated by McLaughlin and Talbert (2006).
- The **transition from intentions and plans to the specific action** of doing and **achieving their goals**. The Innovation Groups at the Novice Level stay at a level of more technical knowledge. In other words, they remain in the phase of planning and of how to do more rather than focusing on the 'why' and 'for what' and, to a lesser extent, on the impact achieved in their own practice. As demonstrated by Ponte et al 2004, teachers approach knowledge based on what they want to do (and rarely on what they want to achieve - effects). Nevertheless, they first reflect based on the desired action rather than what is currently being done. This means that the teachers develop knowledge primarily at the technical level and not so much at the ideological or empirical level. Therefore, assistance must be given to the group members to help them to make these transitions in a planned and

continuous manner, so that they can progress to their next developmental level.

- We have also found that **active participation in prior formative activities**, such as teaching innovation seminars, initial training programmes, innovation projects organised by the University Teacher Training Office, has made it possible to develop positive attitudes towards reflective practice, a greater willingness to continue learning and enquiring into the teaching practice and a certain sensitivity required in order to accept constructive criticism.
- **Institutional support and recognition from co-workers** and other colleagues is a factor that plays an important role. For example, the feeling that one is part of a recognised formative activity that includes advising and institutional recognition promotes the incorporation of many teachers who would otherwise have reservations about these processes. This is related to the tradition of some departments or faculties and the pressures for dedication and assessment of other types of activities such as research, rather than to teaching.
- The **support of the facilitator** as a promoter of reflective processes. It is important that the teachers be aware of their more tacit theories, bring them to light and rebuild them based on theories. This is difficult to achieve without the support of an external person with the ability to do so. That is why the following section is dedicated to them.

Role of the facilitators

As previously explained, each Innovation Group has been assigned a facilitator. The function of this individual, who belongs to the University Teacher Training Team, is to create a learning context for the Innovation Groups. In practice, we have noted that the facilitators act in accordance with the action principles detailed below:

- They carry out monitoring, support and continuity: significant changes and cultural changes take time and need monitoring, support and theories. Continuity is fundamental in innovation projects or groups that have a significant impact on practice itself and guarantee a change in the *habitus* of university teachers.
- They generate interest, awaken concerns and help with self-motivation.

- They suggest a resolution of the problems that concern the groups. It is first necessary to identify these problems and enquire into them, but it is also necessary to generate concern about other types of questions that perhaps have not been posed.
- They provide a space for sharing their learning, achievements and results with other groups, not only for the exchange of experiences but also for the formative activities specifically designed for groups with common needs.

Facilitators cannot make a linear transfer from theory to practice through training or give formulas for the "ought-to-be", let alone act as experts. The facilitator must foster understanding about the problems and their possible alternatives through their own involvement and reflection. This is expressed by facilitator M in her journal:

> *"I think that the facilitator's role as a creator of learning contexts is essential during the first moments of the Group's development. It is the spark that ignites the flame, the first steps, the first questions that help awaken the curiosity to begin setting out challenges. Likewise, I feel that this role is also crucial at the end of the process. From my point of view, if there is no final reflection that helps us to continue progressing, to keep the process going, to turn that final reflection into an intermediate reflection of something bigger, the process of learning, of innovation, of improvement, will come to a standstill. It would be strange, at least if we have set out to make changes, if we have entered processes of self-evaluation, of self-reflection, of self-enquiry and questioning."*

Ponte et al. (2002, p. 419) highlights five characteristics of the facilitation process:

- *Cyclic*, making teachers constantly look back (What have I done?) and forward (How can I progress from here?)
- *Explicit*, clarifying what the teachers were doing and expressing it in action research terms
- *Negotiated*, convincing the teachers, based on arguments, of the best way to proceed in the given circumstances
- *Forceful*, continuously talking with the teachers about the actual carrying out of certain activities, as well as discussing these activities with colleagues in a systematic and purposeful manner

- *Critical*, asking the teachers about what they are doing and why.

In the case of the facilitators of the six Innovation Groups presented here, we have noted that not all of them can have these characteristics due to the maturity levels of the groups. For those groups that are still at the novice level, and even the intermediate level, the facilitator performs functions more related to group coordination and organisation. As stated by McLaughlin and Talbert (2006), functions are carried out that have more to do with task organisation: identifying the issues that the group will be working on, encouraging the sharing of knowledge and advising on the planning of actions. This is noted in the following excerpt by facilitator L:

> *"The Group is still very dependent. They need me to be present at the meetings and they ask me about their action plan. I feel that they are still not independent and my functions at the moment are limited to ensuring a certain continuity and to making sure the members meet and set out their problems."*

Nonetheless, the role of the facilitator in Groups that are at an advanced level changes and becomes more focused on tasks related to creating learning contexts. In this case, they fall in line with those indicated by the aforementioned authors as contexts:

- Focused on knowledge: on problems and practices that make it possible to deepen their conceptual knowledge and skills in a content domain.
- Focused on the community: involving the members of the community in collaborative work that is based on the knowledge of each person and on the building of new understandings and practices.
- Oriented towards improving their teaching practices.
- Putting various strategies and tools into practice.

This is how one of the facilitators describes his role in a group of advanced maturity:

> *"They asked me what had attracted my attention, as a facilitator, with regard to the process followed, focusing on "Why have they done or said that?" But I also added another level: Why didn't I*

pay attention to…? I try to reflect with them on these questions and on what we learn collaboratively about these processes." (Excerpt from the Journal of Facilitator A)

Achievements and results thus far

The results of this formative experience show us that we cannot immediately list tangible and spectacular results, since we cannot alter the processes in a short period of time or through the implementation of certain innovative practices. However, it is with the quality of the processes that we guarantee the best results. In this regard, we can highlight certain achievements:

- An increase in the number of groups registered during the last year.
- The group reports show greater activity and interaction, which has immediate consequences in the implementation of innovations with a significant impact on practice.
- We have progressed, in some cases, from planning and discussion to the implementation of processes with an analysis of achievements and difficulties.
- The incorporation of new members, once they see that the groups' activities work and that they have greater success in the students' learning.
- The strengthening of the sense of belonging to the institution and the satisfaction of having real support and backing.
- Demand for training in dimensions of the teaching-learning process, which previously was not perceived as necessary.
- The support for curriculum planning of cross-cutting and interdisciplinary modules.
- Sustainability and greater autonomy of the facilitator in the group's activities.

Dilemmas and difficulties

A common dilemma is that teachers have the desire to innovate and improve their practices but are faced with insecurity brought about by the implementation of new processes, either because they have no training or they lack prior experience or a hands-on reference. In many cases, they need to see that others can do it before they try it themselves. Therein lies the importance of collaboration for these

types of innovation processes. We have seen that many teachers not only require understanding and time, but also need to experiment on their own, to take risks, to test things out and to reach a certain level of "cognitive disruption" or dissatisfaction with their regular ways of thinking and doing. This requires a loss of control and security with regard to their regular routines in order to be able to build a new "habitus". It is a process that requires a great deal of effort when done in an individual manner, on one's own. That is why collaborative work and institutional support is so important.

Another dilemma is related to the ability to reflect on one's own practice. The more the group members get involved in shared dialogue processes and discussing conceptions, concerns and proposals, the better they are able to accept criticism and work on the continuous improvement of their processes. However, often true reflection is not undertaken, since one tends to stand by new habits or guidelines in which new securities are found. This results in the replacement of certain practices with others, but not always accompanied by changes in conceptions.

From the individual level, it is clear that investing in the facilitator is crucial, but distributed leadership or "peer coaches" must also be strengthened. This contributes to greater development and independence in the Innovation Groups.

We are aware of the need to expand the cases and carry out theoretical sampling, because the experience of incorporating the in-depth analysis of other Innovation Groups enriches and strengthens certain data that will make it possible for us to generate knowledge on the impact of innovation on university classrooms through learning communities.

The fact that it is not just a fad or simple rhetoric must be taken into account. As indicated by Donner et al. (2008, p. 574), "a deeper understanding of what life is like in professional learning communities will challenge professional dialogue beyond the simple rhetoric to encompass more of the harsher realities of group work. This understanding will help educators who wish to become members of professional learning communities to respond more effectively to the challenges associated with collaborative work and to ultimately become more skilled at combining collegial support with the critical dialogue that is necessary for meaningful professional growth".

References

Brockbank, A., & McGill, I. (2002). *Aprendizaje reflexivo en la educación superior.* Madrid: Morata.

Cochran-Smith, M., & Lytle, S. (2002). *Dentro/fuera. Profesores que investigan*. Madrid: Akal.

Cochran-Smith, M., & Lytle, S. (2003). Más allá de la certidumbre adoptar una actitud indagadora sobre la práctica. In A. Lieberman, & L. Miller (Eds.), *La indagación como base de la formación del profesorado y la mejora de la educación* (pp. 65-79). Barcelona: Octaedro.

Christie, D., Cassidy, C., Skinner, D. et al. (2007). Building Collaborative Communities of Enquiry in Educational Research. *Educational Research and Evaluation*, *13*(3), 263- 278.

Dooner, A., Mandzuk D., Rodney, & Clifton, A. (2008). Stages of Collaboration and the Realities of Professional Learning Communities. *Teaching and Teacher Education, 24*, 564–574.

Goodnough, K., Osmond, P., Dibbon, D., Glassman, M., & Stevens, K. (2009). Exploring a Triad Model of Student Teaching: Pre-Service Teacher and Cooperating Teacher Perceptions. *Teaching and Teacher Education, 25*, 285-296.

Grushka, K., McLeold, J., & Reynolds, R. (2005). Reflecting upon Reflection. *Reflective Practice, 6*(2), 239-246.

Hannan, A., & Silver, H. (2005). *La innovación en la enseñanza superior*. Madrid: Narcea.

Hargreaves, A. (2000). Four Ages of Professionalism and Professional Learning. *Teachers and Teaching: Theory and Practice, 6*(2), 151–182.

Harrison, J., Lawson, T., & Wortley, A. (2005). Facilitating the Professional Learning of New Teachers Through Critical Reflection on Practice During Mentoring Meetings. *European Journal for Teacher Education, 28*(3), 267-292.

Könings, K., Brand-Gruwel, S., & Van Merriiënboer, J. (2007). Teachers' Perspectives on Innovations: Implications for Educational Design. *Teaching and Teacher Education, 23*, 985-997.

Kraft, N. (2002). Teacher Research as a Way to Engage in Critical Reflection: A Case Study. *Reflective Practice, 3*(2), 175-189.

Kushner, S. (2002). *Personalizar la evaluación.* Morata. Madrid.

Margalef, L., & Pareja, N. (2008). Innovation, Research and Professional Development in Higher Education: Learning From Our Own Experience. *Teaching and Teacher Education, 24,* 104-116.

Margalef, L. Canabal, C., & Iborra, A. (2006). Transformar la docencia universitaria: una propuesta de desarrollo profesional basada en estrategias reflexivas. *Perspectiva, 49*, 73-89.

Margalef, L., & Álvarez Méndez, J. (2005). La formación del profesorado universitario para la innovación en el marco de la integración en el espacio europeo de enseñanza superior. *Revista de Educación, MECD, 337*, 51-70.

McLaughlin, M. W., & Talbert, J. E. (2006). *Building School-Based Teacher Learning*

Communities: Professional Strategies to Improve Student Achievement. New York: Teachers College Press.

Ponte, P. (2002). How Teachers Become Action Researchers and How Teacher Educators Become Their Facilitators. *Educational Action Research, 10*(3), 399-422.

Ponte, P., Axb, J., Beijaarda, D., & Wubbels, TH. (2004). Teachers' Development of Professional Knowledge Through Action Research and the Facilitation of this by Teacher Educators. *Teaching and Teacher Education, 20*, 571–588.

Postholm, M. (2008). Teachers Developing Practice. Reflection as a Key Activity. *Teaching and Teacher Education, 24*, 1717–1728.

Randi, J., & Corno, L. (2000). Los profesores como innovadores. In Biddle, B. (Ed.), *La enseñanza y los profesores III* (pp. 169-230). Madrid: Paidós.

Zwart, R., Wubbles, T., Bolhuis, S., & Bergen, Th. (2008). Teacher Learning Through Reciprocal Peer Coaching. An Analysis of Activity Sequences. *Teaching and Teacher Education, 24*, 982-1002.

Biographical note

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Exploring Culture in Locally Published English Textbooks for Primary Education in Turkey

Yasemin Kirkgöz*[1] and Reyhan Ağçam[2]

Since language and culture are closely interwoven, the integration of culture into textbooks used for teaching English as a second/foreign language has become a widely accepted phenomenon. This study investigates the cultural elements in locally published English textbooks used for Turkish primary schools following two major curriculum innovations in ELT. A total of 18 textbooks, of which 8 were published after the 1997 curriculum innovation and 10 after the curriculum innovation introduced in 2005, were investigated to find out the extent to which textbooks contain references to the source (Turkish) culture, the target (British/American) culture and the international target culture. A quantitative analysis of the cultural elements demonstrated that while references to the source and target cultures included in textbooks published between 1997 and 2005 outnumber international target cultural components, a different trend was obtained in the cultural analysis of books published after the 2005 curriculum innovation. The study reveals that representations of the source culture, the target culture and the international target culture are favoured in locally produced ELT textbooks in a fairly balanced way.

Key words: Cultural representations, Culture, EFL/ESL, International target culture, Source culture, Target culture, Textbooks

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Introduction: Language and Culture

Language is more than a means of communication since it influences our culture and even our thought processes. It is the expression of human communication through which knowledge, belief, and behaviour can be experienced, explained, and shared, and this sharing is based on systematic, conventionally used signs, sounds, gestures or marks that convey understood meanings within a group or community (O'Neil, 2006). Culture is the complex whole that includes knowledge, beliefs, art, morals, laws, customs and any other capabilities and habits acquired by man as a member of society (Tylor, 1871). It is the product of socially and historically situated discourse, which, to a large extent, is created and shaped by language (Kramsch, 1998). Language is an integral part of a culture, which comprises the totality of beliefs and practices of a society, and is always related to the entities, events, states, processes, characteristics and relations within a culture; a culture depends in large measure on language in order to function and perpetuate itself (Nida, 2003).

During the initial decades of the 20th century, language was viewed by American linguists and anthropologists as being more important than it actually is in shaping our perception of reality (O'Neil, 2006). Today, many linguists, especially those who follow the Communicative Approach, advocate that one can not achieve full competence in a foreign or second language (EFL/ESL) as long as one ignores learning the culture of the people who speak that particular language natively. In other words, the individual needs to know when and how to address someone in the language s/he is attempting to learn in order to be viewed as a successful language learner, otherwise the learning process is deemed to be incomplete.

A number of studies that have been conducted on the relationship between language and culture have indicated that language and culture are mutually integrated. Wenying (2000) proposes that these two phenomena cannot exist without each other, since language simultaneously reflects culture and is influenced and shaped by it, suggesting that languages are culturally loaded. According to her, people of different cultures can refer to different things while using the same language forms. Administering a survey of word association among native speakers of English and those of Chinese, Wenying (2000) has found an intimate relationship between language and culture. Similarly, Brown (2001) contends that language and culture are intricately

interwoven so that one cannot separate them without losing the significance of either language or culture.

It can be concluded from the preceding discussion that any language acquisition process that ignores the culture of the people who speak the language natively would be incomplete. This is a point on which many linguists have recently reached consensus with respect to EFL/ESL teaching. Accordingly, the transmission of cultural information by means of language teaching materials is an issue of wide interest among researchers in the field of ELT. Since learning a new language involves the learning of a new culture (Allwright and Bailey, 1991), language teachers are also teachers of culture, as pointed out by Byram (1989). In a similar vein, Jourdini (2007) is of the opinion that teaching culture as a skill, comparable with reading, writing, speaking, and listening, should no longer be underestimated in language instruction, and that the language instructor should not assume that emphasising the four aforementioned skills is sufficient, as students may have already acquired some knowledge of a particular culture.

Culture in EFL/ESL Textbooks

Throughout history, people have inevitably resorted to a common language, a *lingua franca*, in order to communicate with each other when there has been no shared mother tongue between them. A variety of languages, including Arabic, Chinese, Spanish, French and German, have undertaken this role. However, as Phillipson (2010) highlights, there has been a dramatic decline in the use of other languages in recent years as English has become increasingly popular over the past 40 years, especially in Europe, as illustrated by the following figures.

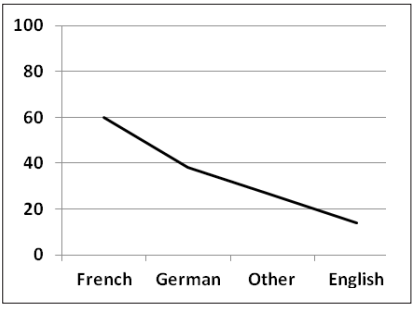

Figure 1. Most frequently spoken languages in Europe (1970)

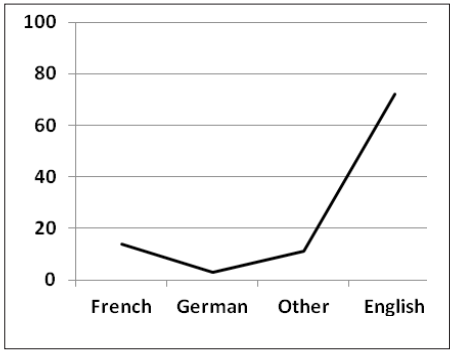

Figure 2. Most frequently spoken languages in Europe (2006)

Considering the fact that it is impossible to account for the existence of one without the other, many linguists strongly suggest that culture should be integrated into EFL/ESL teaching materials (see Alptekin, 1993, 2002; McKay, 2000; Kılıçkaya, 2004). McKay (2000) emphasises that language teaching materials should include a variety of cultural elements in order to help learners develop an interest in language learning and to foster learner motivation. Likewise, Kılıçkaya (2004) suggests that textbooks that focus students' attention on grammatical structures are uninteresting and do not stimulate students who need variety and excitement in language learning in order to develop a genuine interest in the language learning process. Consequently, as posited by Peterson and Coltrane (2003), language classrooms should be environments where learners develop intercultural awareness in their attempt to learn the language; namely, they should know how to address people, make requests, and agree or disagree with someone who is a member of the target language speech community. Thereby, it could be possible for them to view the world from the perspective of others.

Categories of Culture

Cortazzi and Jin (1999) propose three categories in which culture in English textbooks can be investigated. The first category is the source culture, which refers to the learners' native culture. The second category is the target culture where the target language is used as a first language, e.g., American or British culture. The third category is the international target culture, which refers to different varieties of the target culture from both English and non-English speaking countries, e.g., France, Spain, etc. Similarly, McKay (2000) identifies three

types of cultural materials: target culture materials, learners' own culture materials and international target culture materials. She maintains that international target language materials supposedly cover a variety of knowledge from different cultures all over the world using the target language.

Culture in EFL/ESL Textbooks

A number of studies have demonstrated that some locally produced EFL textbooks primarily reflect the source culture of the particular country rather than the target or the international target cultures. Scott (1980), for example, notes that Chinese EFL textbooks are designed to transform and reinforce Chinese norms and values. Similarly, in their investigation of a Venezuelan textbook Cortazzi and Jin (1999) demonstrate that the book mainly gives details of Venezuelan national heroes, while the settings illustrated in the book refer primarily to Venezuelan cities and places. In addition to textbooks that primarily contain the source culture there also exist many EFL textbooks that mainly reflect the target culture. A good example of this is *Success - Communicating in English* (Walker, 1994), produced in USA but marketed to other countries. The textbook portrays the multicultural nature of American society as well as including references to the culture of minorities. A third category of EFL textbooks are those which include a wide variety of cultural values from both English speaking countries and those countries where English is used as an international language. As noted by Cortazzi and Jin (1999), EFL/ESL textbooks in this category include characters from all over the world that use English as a global language in order to promote learners' intercultural competence.

It follows from the above discussion that the learner's perception of his or her own culture, in addition to the foreign and international target culture, is an important factor in the development of his/her cultural awareness. Although the inclusion of the local culture is important in nationally produced materials, it may be argued that EFL/ESL students should also be exposed to materials that focus on the cultures of English speaking countries. This allows students to compare and contrast their culture with other global cultures, increasing their awareness of the social conventions of other cultures and thereby expanding their cultural knowledge. Thus, in using English as an international language a good balance between local, target and international target cultural elements in teaching materials is needed.

The creation of this synthesis would help learners to understand other cultural perspectives. In this way, as contended by Alptekin (2002), "learning a foreign language becomes a kind of enculturation, where one acquires new cultural frames of reference and a new world view, reflecting those of the target language culture and its speakers" (p. 58).

ELT in Turkish Primary Education

The strategic and geopolitical status of Turkey as a crossroad between Europe and Asia makes the learning of English, the main language for international communication as well as the world's *lingua franca* of science, technology and business, particularly important for Turkish citizens in order to enable the nation to pursue its international communication and to keep up with developments in many fields in which English is the most widely used language (Kırkgöz, 2007). Currently, English is offered as the only foreign language at public schools in Turkey. However, it could be inappropriate to claim that the goals of foreign language education have been thoroughly fulfilled in the country. At a press conference held in 2004, the Turkish Minister of Education made a momentous confession: "we do teach English to everybody (students) at schools but nobody can speak it upon graduation". In order to overcome a chronic failure in concern the Ministry of National Education (henceforth MNE) in Turkey made several changes within the framework of the 'Ministry of Education Development Project', which was developed in cooperation with the Turkish Higher Education Council in 1997. As Kırkgöz (*ibid*) states, the project in question aimed to promote the teaching of English in Turkish educational institutions. In accordance with this project, the duration of compulsory education was increased from 5 to 8 years and the starting age for foreign language education was lowered to 4th graders (aged 9) in primary education. The 1997 curriculum stands as a landmark in Turkish history because, for the first time, it introduced the concept of the Communicative Approach into ELT (Kırkgöz, 2005). The basic goal of the policy is stated as the development of learners' communicative capacity in order to prepare them to use the target language (L2) for communication in classroom activities (Kırkgöz, 2007). In Turkey, the second curriculum innovation in the ELT was introduced in 2005. As in the 1997 curriculum, the recent curriculum also highlights communicative views of ELT (for details please refer to Kırkgöz, 2010). Thus, recent regulations concerning foreign language instruction in

Turkish primary schools are intended to raise students who will be able to use the foreign language studied for communicative purposes rather than merely having sufficient knowledge of it to enable them to pass the related examinations offered during the school year.

With regard to language teaching materials, following the introduction of the two aforementioned curriculum innovations (1997 and 2005) a series of locally published textbooks were introduced to be used in Turkish state primary schools. Currently, all state schools use MNE-approved textbooks. Another significant step taken by the Ministry has been the incorporation of elements of the target and international target culture into the foreign language curriculum. Teachers are expected to present the native culture along with the culture of the target language as well as some elements of the international target culture in foreign language classes in order to raise students' cultural awareness. Teaching materials have been designed in accordance with this major goal to fit the language teaching hours. Currently, three lessons per week are allocated to the teaching of English for primary grades 4 and 5 (each class lasting 40 minutes), and four lessons for grades 6 to 8.

The aim of our study is to investigate the extent to which textbooks that are locally published to be used in Turkish primary schools contain the source culture (Turkish), the target culture (British or American) and the international target cultural components. The study also aims to identify whether textbooks published after the 1997 curriculum innovation, as well as those published after 2005, differ with respect to the quantity of cultural components they contain.

Research Methodology

The present study is descriptive in design and is based on a quantitative analysis of the cultural elements in textbooks recommended to be used by the Turkish MNE in state primary education covering grades 4 through 8. Of the two groups of textbooks that have been included in the evaluation process, eight textbooks were published between 1997 and 2004, corresponding to the first ELT curriculum innovation, and ten from 2005 onwards, corresponding to the second ELT curriculum innovation. The following tables provide information about the textbooks investigated.

Table 1. EFL textbooks published between 1997 and 2005

Name of the Book	Grades	Author(s) & Publication Date
Spring	4	Kocaman et al (2000)
Enjoy English	4	Sönmez & Yitim (2004)
Enjoy English	5	Sönmez & Yitim (2004)
English Today	5	Tarlakazan (2004)
A Modern English Course for Turks	6	Akdikmen (1999)
Quick Step	6	Genç, Şeremet & Oruç (2004)
A Modern English Course for Turks	7	Akdikmen (2002)
Easy English	7	Yalçınkaya (2000)

As seen in Table 1, eight of the locally published English textbooks included in the present study were published after the first ELT curriculum innovation covering grades 4-7. Table 2, below, lists ten English textbooks that were published after the 2005 curriculum innovation corresponding to grades 4-8.

Table 2. EFL textbooks published from 2005 onwards

Name of the Book	Grades	Author(s) & Publication Date
Texture English	4	Pakkan (2007)
Time for English	4	Ersöz et al (2008)
Time for English	5	Ersöz et al (2007)
Build Up Your English	6	Erin (2006)
Trip	6	Oztürk (2007)
Spot On	6	Kurt et al (2008)
Spot On	7	Kurt et al (2008)
Let's Speak English	7	Yalçınkaya et al (2005)
Spot On	8	Kurt et al (2008)
Let's Speak English	8	Yalçınkaya et al (2005)

The textbooks identified in Tables 1 and 2 have been randomly selected from among those recommended to be used for grades 4 through 8 in state primary education by the MNE between 1997 and 2009. Each textbook has been examined with respect to the cultural references it includes. The following section describes the way the analysis has been carried out.

Identifying Cultural References

A study was carried out to identify cultural references in each textbook under examination. To carry out the cultural analysis, the total number of units in each textbook was examined with respect to cultural representations both visual (pictures, maps, photographs,

illustrations, etc.) and written (names of characters and places, theme of the written texts, etc.), and a list of different cultural references in each textbook was compiled. The next step involved categorising those cultural references into three categories: the source (Turkish), the target (British/American) and the international target culture (French, German, Spanish, etc.), in accordance with the framework proposed by Cortazzi and Jin (1999) and McKay (2000). Those visuals and written texts that had no direct reference to any culture, some referring to general categories such as students, teachers, doctors, etc., were considered as *culture-free statements* as they did not represent any particular culture and were therefore not included in the cultural analysis.

The process of identifying cultural references in each textbook was carried out independently by each of the authors of the present study. Both assessors agreed on 98% of the cultural references while differences regarding the remaining 2% of the categories were resolved through discussion. The results obtained from this analysis are presented as a whole: source culture, target culture and international target culture, representing the periods 1997-2005 and 2005 onwards, respectively.

Findings

Figure 3 displays the results of the quantitative data in terms of the related percentages produced by the lists of cultural references in the 18 textbooks as a whole, covering the years 1997 to 2005 and 2005 onwards.

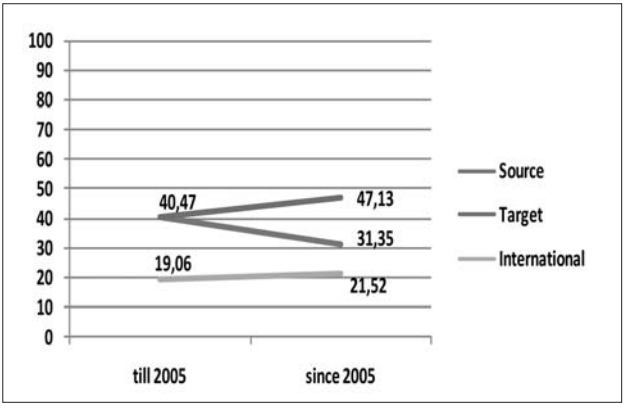

Figure 3. Distribution of the percentages of cultural elements

As can be clearly seen in Figure 3, EFL textbooks for 4th through 8th grades recommended by the MNE between the years in question differ with respect to the dispersion of cultural references they contain. The source and the target cultural references included in the textbooks published between 1997 and 2005 account for 40.47% of the total cultural references, pointing to an equal distribution, whereas cultural references belonging to the international target culture constitute 19.06% of all of the cultural references in the books examined. In other words, references to the source and the target culture outnumber those to the target international culture.

Since 2005, however, there has been a decrease in the number and percentage of references to the source culture in favour of an increase in the target and the international target cultural references. Thus, since the 2005 curriculum innovation references to the target culture have occupied the highest percentage, representing 47.13%, with the source culture occupying the second highest position with 31.35% and the international target cultural references accounting for 21.52%. Although the international target culture constitutes 19.06% of the cultural references in the total texts examined between 1997 and 2005, this percentage increased to 21.52% after 2005.

References to culture in general were manifested in various forms, such as dialogues, pictures, illustrations, activities and short texts. Considering the cognitive developments of learners in different primary grades, the content of EFL culture was presented in situations and topics relevant to learners' daily life experiences. At lower primary grades (4-5), the cultural elements in relation to the source culture were usually introduced through simple topics, including *classroom, family, body parts, home sweet home, food and drinks, colours, introductions, daily routines*. The most common topics dealt with at upper primary grades (6-8) were *the lives of famous people, celebrations, discoveries, jobs, TV stars* and *cities.*

References to the source culture were manifested in various forms. Firstly, Turkish characters were depicted as family members. For example, *Necdet* talks to his brother *Bilge* about what to buy for their mother as a birthday present. Similarly, *Metin, Fatma, Zeynep, Mert* and *Suzan* are displayed as family members, each introducing himself/herself and his/her family members by using a family photo.

Exposure to the source culture was also identified through pictures of different Turkish cities, e.g., *Ankara*, the capital, and various tourist cities, e.g., *Antalya, Istanbul* and *Izmir*. There were also

references to Turkish geography, e.g., *Nemrut Mountain, Manavgat Waterfall* and well known rivers, e.g., *Sakarya*. Other famous historical places referred to include the *Topkapi* and *Dolmabahçe Palaces* and *Euphesis* in *Izmir*. Turkish culture was also manifested through references to history, such as *The Ottoman Empire*, and Turkish cuisine like *coffee* and *Iskender kebab*. Furthermore, references to the Turkish culture are strengthened through characters from Turkish history, e.g., the leader *Mustafa Kemal Atatürk*, and Turkish celebrities such as *Beyazıt Öztürk, Barış Manço* as well as famous sportsmen like *Naim Süleymanoğlu* and the climber *Nasuh Mahruki*. Turkish traditional cultural values are portrayed through a picture of folk dancers dressed in their traditional clothes, and Turkish students celebrating *Children's Day*.

As in the source culture, the target culture was represented through topics engaging students' interest. In books published for lower levels (Grades 4 and 5) elements of British culture were depicted through British newspapers, e.g., *The Daily Mail, The Observer, The Telegraph* and *The Guardian.* Other references to the target culture included characters depicting a British family. The *Smith family* could be seen at home and introduced themselves using a family photo: the children *Tom and Mary*, with *Jane and Paul* as parents. Students' knowledge of British culture is increased through pictures of tourist locations, e.g., *Buckingham Palace, The British Museum, The London Tower, The National Gallery* and *Hyde Park*. Similarly, the impact of the target culture was portrayed by giving information about *London, Wales* and various other British and American cities.

Other examples of the target culture were manifested through references to famous British and American characters. *Oprah Winfrey*, the presenter of an American talk show, was depicted interviewing *Brad Pitt* on a TV programme series. *Madonna* was referred to as a singer giving information about herself, *Elvis Presley* as a rock singer, and *Marilyn Monroe* as a film star. Similarly, *Bill Gates* was depicted as the inventor of Microsoft through a picture portraying him working in his office.

Curtain and Pesola (1994) state that incorporating elements of children's literatures e.g. songs, fairy tales and chants into the foreign language instruction can provide cultural knowledge to learners. Another way in which the target culture was represented was through the story of various cartoon characters, e.g., the *Red Hen* baking bread.

References to the international target culture were mainly from countries such as France, India, Pakistan, Spain and Italy. Intercultural

awareness is manifested through a brief introduction of cities, such as *Venice* in *Italy*, a picture of the *Chinese Wall, the Taj Mahal* in *India, the Eiffel Tower, the Louvre Museum* and *Eurodisney* in Paris, *tulip gardens in Rotterdam; kangaroos in Australia* and *petrol in the Middle East*.

The international culture is also reflected through characters from countries such as Poland, Germany, Austria, France and Russia, and references to famous people from different countries. These characters were mostly based on scientists, singers, writers, inventors, musicians, etc., being the most famous people known all over the world such as *Albert Einstein, Marie Curie, Mozart, Leonardo da Vince, Edison, Mahatma Gandhi* from India and *Winston Churchill*. By including the topics *inventors, explorers* and *discoveries*, upper primary levels introduced learners to various international scientists. *Isaac Newton* is depicted as discovering the law of gravity, while *Benjamin Franklin* is portrayed as discovering electricity. Other manifestations of cultural representations were pictures of flags of different countries, nationalities and currencies that referred to instances of the source, target, and international target cultures.

By integrating the above cultural elements primary education textbooks lay the foundation for culture acquisition at higher levels.

Discussion and Conclusion

The present study investigates whether textbooks published between 1997 and 2005 and those issued from 2005 onwards differ with respect to the cultural elements they contain. The results of the study have revealed that representations of various cultures exist in English textbooks used in state primary education in grades 4 through 8 between 1997 and 2005, and from the 2005 curriculum innovation until the present time. Quantitative analysis of the textbooks recommended by the MNE reveals that the source and the target cultural elements included in textbooks published between 1997 and 2005 outnumber those of the international target cultural components, with source and target culture references indicating an equal distribution, each constituting 40.47% of the total cultural references, while cultural references referring to international target culture account for 19.06% of the total cultural references in the books examined. However, in examining the books published after the 2005 curriculum innovation a different trend is obtained. It was found that references to the target culture (47.13%) outnumber those to the source culture (31.35%) and the international

target culture (21.52%).

The overall results of the study indicate that locally published textbook materials for Turkish state primary education are designed to foster learners' familiarity with the source, target and international target culture simultaneously at every stage of the English language learning experience. In this way, a reasonably good balance between these three sources of cultural elements has been maintained. In so doing, it is hoped that Turkish learners of English will be able to acquire different cultural frames of references, and become aware of their own culture as well as British/American and international target cultural elements simultaneously during the process of learning the English language within the teaching time devoted to teaching and learning English, at a superficial level. Findings of the study also give insights to teachers as users of textbooks in informing them of different cultural elements, and assisting them to integrate different sources of culture into their teaching practice to achieve inclusive teaching practices.

References

Akdikmen, R. (1999). *A Modern English Course for Turks. Grade 6. Student's Book*. Istanbul: Ders Kitapları Anonim Şirketi.

Akdikmen, R. (2002). *A Modern English Course for Turks. Grade 7. Student's Book*. Istanbul: Ders Kitapları Anonim Şirketi.

Allwright, D., & Bailey, K. M. (1991). *Focus on the Language Classroom: An Introduction to Classroom Research for Language Teachers*. Cambridge: Cambridge University Press.

Alptekin, C. (1993). Target Language Culture in ELT Materials. *ELT Journal, 47*(2), 136–43.

Alptekin, C. (2002). Towards Intercultural Communicative Competence in ELT. *ELT Journal, 56*(1), 57–64.

Brown, H. D. (2001). *Principles of Language Learning and Teaching*. Beijing: Foreign Language Teaching and Research Press.

Byram, M. (1989). *Cultural Studies in Foreign Language Education*. Clevedon: Multilingual Matters.

Curtain, H., & Pesola, C. A. B. (1994). *Language and Children: Making the Match*. (2nd ed.). London: Longman.

Cortazzi, M., & Jin, L. (1999). Cultural Mirrors: Materials and Methods in the EFL Classroom. In E. Hinkel (Ed.), *Culture in Second Language Teaching and Learning* (pp. 196-220). Cambridge: Cambridge University Press,.

Erin, Y. (2006). *Build Up Your English for Grade 6. Student's Book*. Istanbul: Cemre Publishers.

Ersöz, A., Çakır, A., Cephe, P., Peker, G., Özkan, N., & Demir, G. (2008). *Time for English. Grade 4. Student's Book*. (2nd ed.). Ankara: MEB.

Ersöz, A., Çakır, A., Cephe, P., Peker, G., Özkan, N., & Demir, G. (2007). *Time for English. Grade 5. Student's Book*. Ankara: MEB.

Genç, H., Şeremet, C., & Oruç, N. (2004). *Quick Step. Grade 6. Student's Book*. Ankara: İmaj Publishers.

Jourdini, M. (2007). *The Fifth Skill: Culture as a Language Learning Motivator*. Retreived from http://www.stoa.org.

Kılıckaya, F. (2004). Authentic Materials and Cultural Content in EFL Classrooms. *The Internet TESL Journal*, *10*(7). Retreived from http://iteslj.org/.

Kırkgöz, Y. (2005). English Language Teaching in Turkey: Challenges Towards the 21st Century. In G. Braine (Ed.), *Teaching English to the World History, Curriculum and Practice* (pp.159-169). London: Lawrence Erlbaum.

Kırkgöz, Y. (2007). English Language Teaching in Turkey: Policy Changes and their Implementations. *RELC Journal, 38*(2), 216-228.

Kırkgöz, Y. (2010). Teaching English at Primary Education: From Policy Planning to Practice. In B. Haznedar, & H. H. Uysal (Eds.), *Handbook for Teaching Foreign Languages to Young Learners in Primary Schools* (pp. 23-41). Ankara: Anı Publications.

Kocaman, A., Tataroğlu, N., & Özgüler, Ü. (2000). *Spring. Student's Book. Grade 4*. Ankara: Özgün Publishers.

Kramsch, C. (1998). *Language and Culture*. Oxford: Oxford University Press

Kurt, C. B., Burdur, P. Ü., Çoban, Ö., Norşenli, F., Sarandal, M., Tekir, S., & Sayıner, İ. (2008). *Spot On. Grade 6. Student's book.* İstanbul: Milsan Publishers.

Kurt, C. B., Burdur, P. Ü., Çoban, Ö., Norşenli, F., Sarandal, M., Tekir, S., & Sayıner, İ. (2008). *Spot On. Grade 7. Student's book*. İstanbul: Rotamat Publishers.

Kurt, C. B., Burdur, P. Ü., Çoban, Ö., Norşenli, F., Sarandal, M., Tekir, S., & Sayıner, İ. (2008). *Spot On. Grade 8. Student's book*. İstanbul: Feza Publishers.

McKay, S. L. (2000). Teaching English as an International Language: Implications for Cultural Materials in the Classroom. *TESOL Journal, 9*(4), 7-11.

Nida, E. A. (2003). Language and Culture. In S. Mejri (Ed.), *Traduire la Langue, Traduire la Culture* (p. 193). Paris: Maisonneuve and Larose.

O'Neil, D. (2006). *Language and Thought Process.* Retreived from http://anthro.palomar.edu/language/language5.htm.

Oztürk, S. A. (2007). *Trip. Student's book*. Ankara: Anıttepe Publishers.

Pakkan, G. (2007). *Texture English. Grade 4. Student's book*. Ankara: Doku Publishers.

Peterson, E., & Coltrane, B. (2003). *Culture in Second Language Teaching*. Eric Digest EDO-FL-03-09. Center for Applied Linguistics.

Phillipson, R. (2010). Realities and Myths of Linguistic Imperialism. *Journal of Multilingual and Multicultural Development, 17*(6), 485–96.

Scott, C. S. (1980). Some First Impressions of EFL Teaching in China. *TESOL Newsletter, 14/6*(11), 13-43.

Sönmez, A., & Yitim, B. (2004). *Enjoy English. Grade 4. Student's Book.* (2nd ed.). İstanbul:

Doğan Publishers.

Sönmez, A., & Yitim, B. (2004). *Enjoy English. Grade 5. Student's book.* (3rd ed.). İstanbul: Doğan Publishers.

Tarlakazan, İ. (2004). *English Today. Grade 5. Student's Book*. Ankara: Tuna Publishers.

Tylor, E. (1920) [1871]. *Primitive Culture.* New York: J. P. Putnam's Sons.

Walker, M. (1994). *Success - Communicating in English*. Addison Wesley Publishing Company.

Wenying, J. (2000). The Relationship between Culture and Language. *ELT Journal, 54*(4), 328-334.

Yalçınkaya, L. (2000). *Easy English. Grade 7. Student's Book.* (2nd ed.). Ankara: Semih Publishers.

Yalçınkaya, L., Keser, S., Boztepe, N., Akın, N., & Atabay, S. (2005). *Let's Speak English. Grade 7. Student's Book*. (2nd ed.). İstanbul: Devlet kitapları müdürlüğü.

Yalçınkaya, L., Keser, S., Boztepe, N., Akın, N., & Atabay, S. (2005). *Let's Speak English. Grade 8. Student's Book.* (2nd ed.). İstanbul: Devlet kitapları müdürlüğü.

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Postgraduate Students' Perception of Creativity in the Research Process

Mojca Juriševič[1]

The purpose of the research was, with the aid of a short questionnaire, to determine how postgraduate students (N = 32) perceive the opportunities for creative research in general, and how they perceive creativity in the preparation of their own research work in particular. Descriptive analysis shows that students (1) perceive a positive study-research climate that encourages creative processes (independence, motivation, intellectual challenges), (2) judge that researchers have numerous opportunities for creative work in the various phases of research and (3) evaluate themselves as highly creative individuals in everyday life. Students perceive themselves as being at their most creative in the definition of the research problem, which they mainly identify with the use of personal strategies (work experience) and take various lengths of time to form, typically up to one year. The most difficult problem in this regard is represented by giving meaning to the problem (breadth, depth, specificity, application). Amongst the perceived encouragement with which mentors motivate students for creative research the most frequent is less directive general guidance in study and research. On the basis of the presented findings, guidelines are suggested for the more effective encouragement of creative research in postgraduate students.

Key words: Postgraduate study, Research, Research problem, Scientific creativity.

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Through phylogeny, creativity is the central motor of human development in various areas, from the solving of everyday life problems through the arts and economics to science, which with its achievements contributes to sustainable development - economic, social and environmental (Beghetto and Kaufman, 2007; Collins, 2007; Runco, 2004; Sawyer, 2006; Stehr, 1994; Sternberg and Lubard, 1999; Weisberg, 1993). In his resounding work *Antropologija ustvarjalnosti* (The Anthropology of Creativity), Makarovič (2003) asserts that creativity is "…the *highest* human manifestation, the very highest expression of humanity, which as such presupposes the *entirety* of human reality." (p. 47). Today, we generally understand creativity as a psychological phenomenal that manifests itself in the form of the production of ideas - new and unusual ideas, but ideas that are effective and useful for particular purposes (Amabile, 1996; Ochse, 1990; Sternberg, 2003), with regard to which the ethical dimension of creative ideas is increasingly taken into account (Cropley, 2009). Defined in this way, creativity is closely linked with the concept of divergent thinking, as initially developed in the area of researching creativity by Guilford (1950). Divergent thinking is defined as the basis for creativity and is determined by four attributes: (1) fluency - the ability to quickly produce a large number of ideas or solutions to a particular problem, (2) flexibility - the ability to produce various ideas or to simultaneously take into account various aspects in problem solving, (3) originality - the ability to produce new and unusual (rare) ideas and (4) elaboration - the ability to reflect deeply on ideas and to work ideas out in detail. Although in his work Guilford does not explicitly emphasise the applicative value of ideas, this value is particularly important. Not all that is new is creative; we can only consider creativity in cases where ideas fulfil exterior criteria of individual and social wellbeing (Cropley, 2009; Pečjak, 1987). Furnham and Bachtiar (2008) emphasise that, due to its multi-component nature and complexity, creativity is difficult to define precisely, as well as being difficult to measure. On the basis of more than 60 definitions of creativity they determine that the most important components for defining creativity are cognitive ability, personality traits, cognitive styles and motivation. Similar conclusions are arrived at by Makel and Plucker (2008), who synthetically combine the authors of various definitions of creativity into three large groups: (1) psychometric, who attempt to understand creativity from the point of view of the structure (of the various components) of creativity, (2) developmental, who explain creativity from the point of view of developmental dynamics and

(3) contextual, who emphasise the sociocultural aspect of understanding creativity, in the sense of the various factors that influence creativity (cf. Amabile, 1996; Csikszentmihalyi, 1999; Gardner, 1993; Hemlin, Allwood & Martin, 2004; Sternberg & Lubard; 1996; Torrance, 2004; Urdan, 2007). In view of the above, for the purpose of understanding creativity in the continuation of the present article it seems sensible to accept an operational definition that combines all of the aspects of creativity mentioned so far: "Creativity is the interaction among *aptitude, process, and environment* by which an individual or group produces a *perceptible product* that is both *novel and useful* as defined within a *social context.*" (Plucker, Beghetto & Dow, 2004, p. 90).

Creativity in scientific research

Craig (1990) emphasises four conditions for a successful career in science: (1) knowledge, (2) technical skills, (3) communication skills and (4) originality or creativity. The latter is of particular importance, as the problems of scientific research are complex and multivariate, as well as being oriented towards innovative solutions. Amabile, Conti, Coon, Lazenby and Herron (1996) emphasise that "every innovation begins with a creative idea" (p. 1154) and that creativity can be thought of as the creation of new meaningful ideas, while innovativeness is the transformation of these ideas into useful new products, with both processes arising as a function of the interaction between the individual and his or her environment. Similarly, Sawyer (2006) finds that a common characteristic of the most influential and most important scientists is their inexhaustible creativity, a fact that can be well explained from the sociocultural point of view; the most important scientific discoveries arise through the high level cooperation of scientific teams, which demonstrates that "scientific creativity is both a psychological and social process" (p. 278; see also L'Abate, DeGiacomo, Capitelli & Longo, 2009; Miller, 2000). In his thinking, Simonton (2003) combines both approaches to understanding creativity: the point of view of the personality traits of creative scientists and that of the creative processes that take place during research. He explains scientific creativity as a stochastic structure in which a third element is also integrated: the creative product (creative ideas). Only the latter can enable a complete insight into the phenomenon of creativity, while the first two provide only a partial picture, as they are simultaneously determined and limited by the research paradigm in the background. Studying personality traits follows the tradition of the psychology of individual differences

and correlational research, whereas studying processes takes place more in the domain of cognitive psychology and is experimentally based. Simonton (2003) explains the aforementioned partialness with the expression "not to see the forest for the trees" (p. 490), and as a way forward suggests research of real creative behaviour. According to his theory, creative achievements in scientific research come about as events with a low probability – in line with Poisson distribution; quality creative products are a probability product of the quantity of products, which in the end means that the probability of the phenomenon of a high quality creative product is greatest in the most fertile period in the life of the researcher and of the scientific community to which he or she belongs. Simonton's model of stochastic combinatorics confirms the findings of a study undertaken by Adelson (2003), in which the author interviewed eight scientists - Franklin Institute prizewinners for 2002 - and on the basis of their stories worked out a very dynamic picture of the concept of scientific creativity. Amongst her most important findings, one that stands out is the scientists' self-image of extreme diligence; in spite of their extraordinary creative scientific achievements, the interviewees do not perceive themselves as possessing above average talent and creativity, but rather report a high level of involvement and persistence, as well as personal engagement in scientific work, while stating the main reason for their scientific success as their analytical abilities (not intuition, A/N), high intrinsic motivation, positive self-concept and the absence of competitive pressures. Alongside Pasteur's supposition that "chance favours the prepared mind", these findings confirm Simonton's understanding of scientific creativity.

Heinze, Shapira, Rogers and Senker (2009) explain that, as in other fields, creativity in scientific research is defined as "knowledge and capabilities that are new, original, surprising, and useful" (p. 611), to which Charyton and Snelbecker (2007) add the observation that scientific creativity differs from artistic creativity, for instance, primarily in its special emphasis on the attribute of function or applicative value (usefulness); furthermore, more so that in other fields, scientific and creative achievements and innovations are very precisely evaluated on the basis of highly developed scientific criteria, such as publicity, validity and originality (Simonton, 2004; Soler, 2007).

Types of scientific creativity

Heinze, Shapira, Rogers and Senker (2009) proposed a typology of scientific research creativity that emphasises the functional characteristics of creative novelties and is linked with the various phases of the research process: defining the research problem, planning the research method, gathering data, analysis and/or preparation of the research report. They assume five different kinds of research creativity, which are typically interlinked (Heinze et al., 2007, p. 132):

- Formulation of a new idea (or a set of new ideas) that opens up a new cognitive frame or brings theoretical claims to a new level of sophistication (e.g., Einstein's Theory of Specific Relativity).
- Discovery of new empirical phenomena that stimulate new theorising (e.g., Darwin's Theory of Evolution).
- Development of a new methodology, by means of which theoretical problems can be empirically tested (e.g., Spearman's Theory of Mental Abilities).
- Invention of novel instruments that open up new research perspectives and research domains. (e.g., Binnig and Rohrer's Nanotechnology).
- New synthesis of formerly dispersed existing ideas into general theoretical laws enabling analyses of diverse phenomena within a common cognitive frame (e.g., Bertalanffy's General Systems Theory).

The development of the creative idea in scientific research

Wallas (1926, cited in Cropley, 2009) explains the development of the creative idea or product with the aid of a four-level development model that is today regarded as a classic. In the first phase, the individual first becomes familiar with the idea (information); there follows an incubation phase (the idea "prepares" itself), while in the phase of illumination the solution (suddenly) arises, which the individual then verifiers in the concluding phase (verification). From the point of view of the sociocultural paradigm, which emphasises the role of the social environment and context for creativity, Wallace's model becomes too narrow; therefore, Cropley (2009) adds two more phases: the phase of communicating the idea to other people and of their

feedback (evaluation) regarding the effectiveness of the idea. In addition to this, Cropley includes another introductory phase in the model; he calls this the phase of preparation, in which the individual becomes aware of the problem and develops a purpose. Cropley's model of the development of the creative idea is shown in Table 1. A familiarity with this model is important both for understanding the dynamics of creativity as a stochastic structure in Simonton's sense and for encouraging creative thinking in various areas, as with a precise knowledge of the described characteristics we can select individual activities for encouraging specific processes in a more strategic way.

Table 1. Creative processes, traits and motives in the phases of the production of novelty (Cropley, 2009, p. 73)

Phase	Process	Results	Motivation	Personality	Feelings
Preparation	Identifying problem Setting goals Convergent thinking	Initial activity General knowledge Special knowledge	Problem-solving drive (intrinsic) Hope of gain (extrinsic)	Critical attitude Optimism	
Information	Perceiving Learning Remembering Convergent thinking	Focused special knowledge Rich supply of cognitive elements	Curiosity Preference for complexity Willingness to work hard Hope of gain	Knowledge ability Willingness to judge and select	Dissatis-faction
Incubation	Divergent thinking Making associations Biociation Building networks	Configura-tions	Freedom from constraints Tolerance for ambiguity	Relaxedness Acceptance of fantasy Non-conformity Adventuro-usness	Interest Curiosity
Illumination	Recognising a promising new configuration	Novel configura-tions	Intuition Reduction of tension	Sensitivity Openness Flexibility	Determin-ation Fascination
Verification	Checking relevance and effectiveness of novel configuration	Appropriate solution displaying relevance and effectiveness	Desire for closure Desire to achieve quality	Hard-nosed sense of reality Self-criticism	Excitement

Communi-cation	Achieving closure Gaining feedback	Workable product capable of being made known to others	Desire for recognition (intrinsic) Desire for acclaim or reward (extrinsic)	Self-confidence Autonomy Courage of one's convictions	Anticipat-ion Hope Fear
Validation	Judging relevance and effectiveness	Product acclaimed by relevant judge (e.g., teacher)	Desire for acclaim Mastery drive	Toughness Flexibility	Elation

Leong and Pfaltzgraff (1996) explain that "finding" a genuine research idea is an important creative moment in research work. Although conditioned primarily by the researcher's personal interests, this process can be made easier if the researcher approaches it strategically, on the basis of knowledge and with the combined application of various searching strategies; amongst these strategies the author emphasises (1) personal strategies, on the basis of personal experience and observation (personal preferences, previous work, work environment, media), (2) interpersonal strategies, on the basis of communication with reference individuals or groups (mentors, professors, researchers, colleagues, participation in various scientific research meetings), (3) the strategic use of printed sources, on the basis of individual study of the literature (books, journals, various types of reports) and (4) the strategic use of electronic sources of information (ICT), on the basis of various databases and other Internet sources.

Purpose of the research

In the research we were interested in how postgraduate students perceive the scientific research community, that is, the environment for creative research, and, just as importantly, how they perceive their own competence for creative research within the framework of postgraduate study. Zgaga (2007) explains that with the introduction of new (doctoral) programmes within the framework of Bologna study there has been a significant change in the "architecture" of study. Although certain weaknesses are already evident in the new system (e.g., consequences of the large number enrolments) specific advantages are also clear, in particular originality in research and the encouragement of high quality new (interdisciplinary) knowledge. Special emphasis has also been placed on the role of the mentor, the formation of research

communities and the purpose of education on the doctoral level, which no longer simply serves the needs of the university but rather focuses on the needs of society in general. It is possible to follow and encourage these advantages with the goal of sustainable development.

In the explorative research described in the continuation, we set four research questions: (1) How do postgraduate students perceive a research environment or climate that encourages creativity? (2) How do students perceive the opportunities for creative research? (3) How do students evaluate their own achievements in the research process? and (4) What kind of mentor encouragement for creative study do the students perceive?

Method

Participants

32 first year postgraduate students at the Faculty of Education of the University of Ljubljana during the 2009/2010 academic year participated in the research (43%). They were masters students studying Preschool Education, and Supervision, Personal and Organisational Counselling, as well as doctoral students of Teacher Education and Educational Sciences[1]. At the time of the research, the subjects tested had an average age of 33.1 years (SD = 6.6 years), and the sample included 31 woman and 1 man.

Instrument and procedure

The participants filled out a short combined questionnaire that was designed for the purpose of the study. The questions related to how the postgraduate students perceived creativity in research. There were five open questions and three questions that students responded to on an attached assessment scale. The questions were:

1) On a seven-level scale (from 7 - completely true, to 1 - certainly not true) assess how you personally experience the various aspects of your research work within the framework of postgraduate study.

1 We included students from both the masters and doctoral study programmes (second and third Bologna cycles) together in the same sample, as in preliminary analysis we did not find significant differences between the answers of the participating students. They were all Bologna first generation students at the Faculty of Education, University of Ljubljana.

2) On a five-level scale (from 5 – very creative, to 1 – completely uncreative) assess how creative, in your personal opinion, researchers can be in the individual phases of research work.
3) On a five-level scale (from 5 – very creative, to 1 – completely uncreative) assess your own creativity in general in life.
4) In your personal opinion, where does the central originality of your research work lie?
5) Describe as precisely as possible how you identified and defined your research problem, that is, what led you to your research idea.
6) How much time did you need to define your research problem?
7) What difficulties did you face while defining your research problem?
8) Describe in the most concrete terms possible how your mentor at the faculty has until now encouraged you to engage in original research work or to seek innovative research solutions.

For the sake of economy, the survey was executed through email and was completely voluntary. It took place at the end of the second semester of study (July 2010), when the students had already acquired basic study-research experience and had begun to prepare the theses for their research.

The data was analysed descriptively (basic statistics were calculated) and qualitatively (the content of the responses to the questions was analysed).

Results

Experience of the climate of research work in postgraduate study

On a seven-level assessment scale, students assessed nineteen components of climate as they perceived it during their research work. These components were included in the question on the basis of findings by authors who have researched work climate connected with creative processes (Amabile, 1996; Amabile, Conti, Coon, Lazenby & Herron, 1996; Ekvall, 1996; Hunter, Bedell & Mumford, 2007). In general, students assess the motivating components of climate highly ($M_{average} = 5.65$) and perceived an average presence of the demotivating

components of climate ($M_{average}$ = 3.23). The average arithmetic means and standard deviations for the individual components are shown in Table 2. In their research work, students most intensely experience independence (M = 6.22, SD = 0.91), motivation (M = 6.06, SD = 1.01) and intellectual challenges enabled by research (M = 6.00, SD = 0.92). At the other end of the scale, they do not perceive a great deal of a rivalry between students themselves (M = 2.19, SD = 1.31), nor do they feel lonely in their study or research (M = 2.48, SD = 1.52).

Table 2. Perception of climate in research work in postgraduate study on a seven-level assessment scale.

Components of research climate	*N*	*M*	*SD*
Independence	32	**6.22**	**0.91**
Opportunity for discussion	32	5.94	1.01
Rivalry*	32	2.19	1.31
Dependence*	32	3.12	1.34
Own competence	32	5.50	0.84
Excessive demands of study*	32	3.44	1.39
Positive encouragement for research	32	5.44	1.41
Support in research	32	5.38	1.52
Creativity	32	5.10	1.01
Time pressure*	32	4.72	1.63
Cooperation	32	5.53	1 27
Motivation	32	**6.06**	**1.01**
Loneliness*	32	2.48	1.52
Stress*	32	3.84	1.82
Satisfaction	32	5.25	1 16
Trust	32	5.53	1.32
Intellectual challenges	32	**6.00**	**0.92**
Tolerance	32	5.45	1.15
Relaxed atmosphere	32	5.31	1.12

Note. *Demotivating components of climate. The statistics for the components that received the highest assessment are presented in bold type.

Opportunities for creativity in research

Students judge that in general researchers can be creative in all phases of the research process ($M_{average}$ = 3.91). In their opinion, researchers can best express their creativity in the execution of research (M = 4.41, SD = 0.76) and in the definition of the research problem (M = 4.34, SD = 0.86), while students attribute the least opportunity for creativity in research in the processing of data (M = 3.00, SD = 1.19), although this too receives an above average assessment (Table 3).

Table 3. Assessment of opportunities for the creativity of researchers in the individual phases of research work, on a five-level assessment scale.

Phase of research work	*N*	*M*	*SD*
Definition of research problem	32	4.34	0.86
Preparation of theoretical background	32	3.22	1.13
Preparation of research method	32	3.69	0.93
Execution of research	32	4.41	0.76
Data analysis	32	3.00	1.19
Presentation of results	32	4.03	1.12
Discussion	32	4.19	0.74
Preparation of conclusions	32	4.25	0.80
Publishing of research work	32	4.09	0.78

Perception of own creativity in everyday life

On a five-level scale, students made a high assessment of their own creativity in everyday life (M = 4.4, SD = 0.66) (Figure 1).

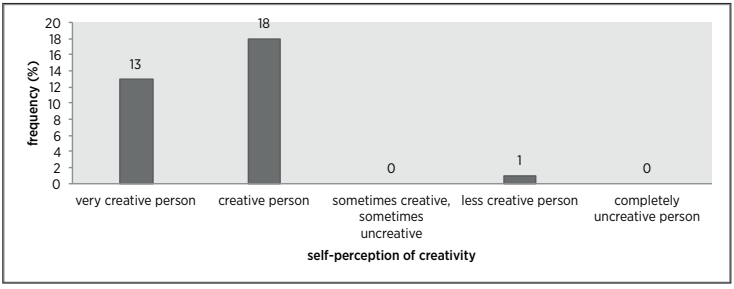

Figure 1. Assessment of own creativity in everyday life on a five-level assessment scale (N = 32).

Perception of originality in the area of own research

Students see the central originality of their own research work in the definition of the research problem (52%) and in the explanation of the research findings (48%), and less frequently in the selection or definition of the research method (12%). 16% of responses were classified in the category "other"; these are responses that appeared only once or in terms of content were impossible to combine into an individual category (e.g., the promotion of the work of hospital preschool teachers, the Roma question, preparation of a special programme) (Figure 2).

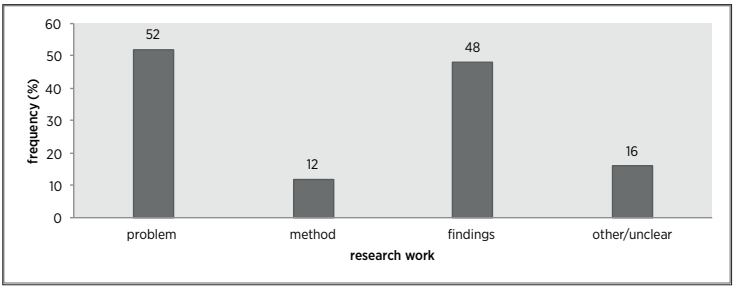

Figure 2. Perception of the central originality in own research work.

Strategies for defining the problem and timeframe

The results show (Figure 3) that in defining the research problem the majority of students (94%) proceed primarily from their own professional experience and practice, 26% of students define the problem with the assistance of discussions with mentors and colleagues, while theoretical studies provide the basis for the definition of the problem for 22% of students; as a method for defining the problem, e-sources are used the least (3%).

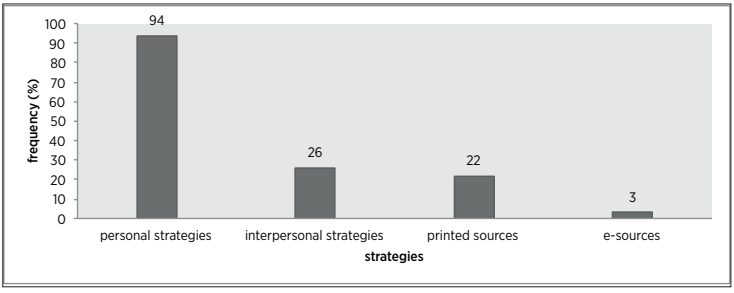

Figure 3. Strategies used for defining the research problem.

From the responses of students, it is possible to conclude that their perceptions of the time used to define the research problem are diverse (Figure 4). They stated that the time used in defining the problem ranged from a few hours to a few days (one week – 19%), from several weeks to five months (one semester – 28%) from the commencement of study to ten months (two semesters – 25%), and a longer time, from the period prior to enrolment in postgraduate study or several years (one year or more – 16%). Three students were completely unable to state a timeframe in which they defined the research problem: "It is very difficult for me to decide, as I surveyed various literature and at the same time considered a range of possibilities, therefore I cannot define this in time."; "It is difficult

for me to define, because I have been dealing with the theme for many years."; "In fact, this theme has interested me for a long time".

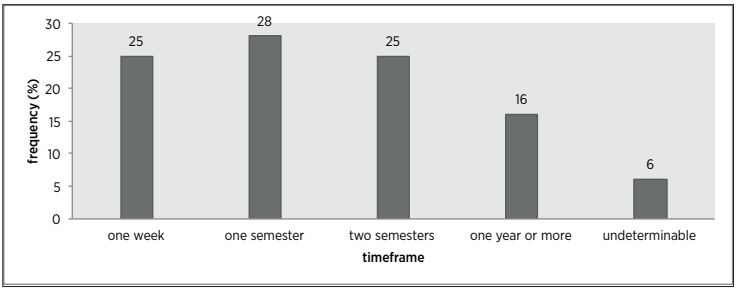

Figure 4. Timeframe for defining the research problem.

Difficulties in defining the research problem

Three students stated that they had no difficulties whatsoever in defining the research problem. The remaining students most frequently (46%) encountered difficulty in giving meaning to the research through narrowing and elaboration of the research problem (i.e., the breadth, depth, specificity and application of the research, clearly designing research questions, establishing the hypothesis), as well as in finding relevant literature (14%). The question of the actual (technical) feasibility of the research (10%) was also emphasised as a difficulty, as well as time pressure of various kinds, such as the overburdening of the student due to work obligations and the short deadline for submitting the thesis (8%), difficulties in communication with the mentor (8%), and insufficient knowledge in the area of scientific writing (8%) and research methodology (6%) (Figure 5).

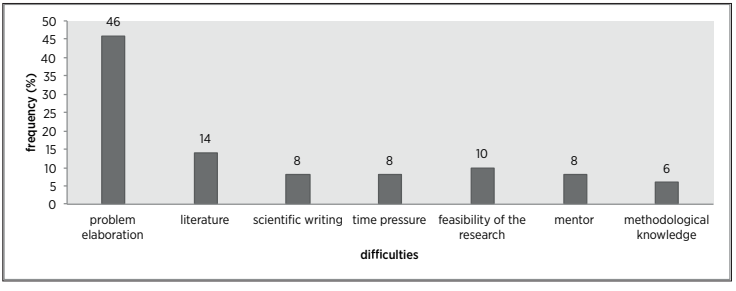

Figure 5. The perceived difficulties in defining the research problem.

Perceptions of the encouragement of mentors for the creative research of postgraduate students

The most frequent form of encouragement perceived by students for creative work within the framework of research is general, less directive encouragement, in the sense of listening to the student, posing questions, discussions and general guidance in study and research (50%). Students also perceive the mentor's encouragement of creative research work in the form of encouragement to study the literature (16%), going into the problem and the research question in more depth (11%) and the research method (11%); later, encouragement is also perceived in the form of socialisational encouragement in the scientific-research space by enabling participation in conferences and collaboration in research projects (5%), the use of the techniques creative thinking (e.g., brainstorming, target, carousel) (5%) and with the mentor's own example - the mentor as a creative person (2%). The results according to the stated content categories are shown in Figure 6. In their responses, five students emphasised ineffective communication with the mentor, whether due to unsuccessful time coordination or the mentor's overburdening or absence, which was demotivating for the student regarding (creative) research work within the framework of postgraduate study. Two students did not provide an answer to this question.

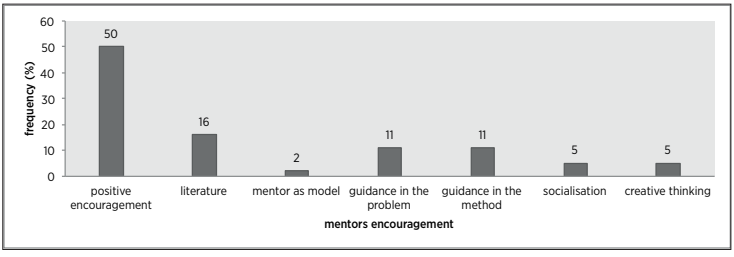

Figure 6. Perceptions of the mentors' encouragement of creative and innovative research work in postgraduate study.

Discussion

The purpose of the research was to study how postgraduate students perceive the opportunities for creative research in general, and how they perceive creativity in the preparation of their own research work in particular. The results show that students perceive a positive study-research climate that encourages creative processes, and that

they believe that researchers can be creative in various phases of the research process (Amabile, 1996; Craig, 1990; Hemlin, Allwood & Martin, 2004; Hennessay, 2006, Matelič, Mali & Ferligoj, 2007). Students experience intense feelings of independence and motivation for their own research, as well as the intellectual stimulation of postgraduate study. They also give a high appraisal of other components that stimulate creative work - the possibility of discussion, the perception of one's own competences, the mentor's positive encouragement of research and support, cooperation, satisfaction, trust, tolerance and a relaxed atmosphere - while their appraisal of the components of rivalry, loneliness and dependence is much lower. On the basis of various empirical studies, Usher and Parker (2002) summarise similar contextual components that, in their opinion, have a significant influence on creativity in work groups; these components are work and tasks (independence, complexity, stress, etc.), social characteristics (communication, cooperation, etc.), and organisational characteristics (climate, organisation of work, etc.). All of these attributes are extremely important for the development of the inner motivation that researchers direct towards the process of research (cf. Adelson, 2003). Ryan and Deci (2000), authors of the Self-Determination Theory, explain that people are, by our very nature, proactive and oriented towards activities that satisfy three basic needs: the need for *autonomy* (the feeling that we manage ourselves and decide about ourselves), *competence* (the feeling that we are able to undertake or carry out a particular task) and *relatedness* (the feeling of being accepted by and connected to a broader social group). These needs condition the feeling of individual satisfaction, which in turn encourages tenacity and creative learning, as well as strengthening inner motivation. The significance of intrinsic motivation for the development of creativity is also emphasised by other authors (e.g., Amabile, 1996; Sternberg & Lubard, 1996), but of particular importance is the contribution by Csikszentmihalyi (1999), for whom there is no creativity without motivation. Csikszentmihalyi explains the role of intrinsic motivation in creative work in his Flow Theory, in which he defines "flow" as "optimal experience", that is, the central motivational characteristic: "A sense that one's skills are adequate to cope with the challenges at hand in a goal directed, rule bound action system that provides clear clues as to how one is performing. Concentration is so intense that there is no attention left over to think about anything irrelevant or to worry about problems. Self-consciousness disappears, and the sense of time becomes distorted. An activity that produces such experiences

is so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous." (Csikszentmihalyi, 1991, p.71). It is also possible to explain the findings of Adelson (2003) from the perspective of "flow" experience when she states that first class scientists use a great deal of time for their research work and are unable to define this time precisely as they are practically constantly (as well as unconsciously) engaged with the problems that they are researching, that is, that they experience intrinsic motivation for their research. The results of the present study also show that most postgraduate students deal with their research problem for an extended period of time and that they experience intrinsic motivation for their research. This is further supported by the fact that the majority of the students "seek" their research problem in their own work experience, and that in seeking their research problem they most frequently use a "personal strategy" (Leong and Pfaltzgraff, 1996). In view of the responses, it is possible to conclude that in the forming their research problem students are guided by the "sense" or "usefulness" of the problem with regard to the goal of gaining a deeper knowledge of their own (educational) practice or of modifying this practice, and thus form the research problem on the basis of acquired work experience. Considering the age of the test subjects, it is possible to presume that they have an average of ten years of work experience; according to various authors (cf. Levin, 2008), work experience of this extent coincides with a decentration of thinking, that is, with a conceptual shift from thinking about one's own professional role to thinking about educational practice and the various participants in and users of this practice. According to the responses to the questions in our research, it is with these problems that the participating postgraduate students are engaged. An important question that therefore remains open for the moment is that of the actual originality of the research problems and their expected "solutions" by students in the broader scientific research sphere. Creativity in research is conditioned by the extensive knowledge ("mastery of the subject") that is the gained by studying the relevant literature (Leong & Pfaltzgraff, 1996); however, the students report that only rarely do they use the strategies of printed or ICT sources. Furthermore, they also cite a range of difficulties in defining the research problem (difficulties in narrowing and perfecting the problem, in forming the research questions, in the research methodology), which can be attributed also to the development of the research idea, that is, the period between "preparation" and "information" (Cropley,

2009). For this reason, this set of findings is particularly telling for the academic institution, indicating the sense in supporting students in the use of various study strategies in order to achieve the most effective possible elaboration of the research problem (cf. Cropley, 2009; Flippo & Caverly, 2009). In addition to learning strategies for encouraging creativity in higher education, Candy, Crebert in O'Leary (1994, cited in Cropley, 2009) also suggest more systematic encouragement of the development of a research mental attitude (curiosity, critical thinking, self-regulation of learning), the mastery of the specific content area and of broader connections with other areas, information literacy (from searching for information to its use), and "personal urgency" linked with a good self-concept in the area of research. To this list, Craig (1990) adds a series of techniques for encouraging creative thinking, with which it is possible to stimulate creativity in research in all of the aforementioned areas. In addition, he highlights the principle of gradualness, as it is unrealistic to expect that on taking on their new role young researchers will suddenly or automatically become independent thinkers and/or creative problem solvers, insofar as in their learning history they were only encouraged to convergent thinking (seeking the one correct solution) without (many) opportunities for research learning and problem solving and innovation.

Half of all of the answers given by the students in connection with the question of the support of mentors in their creative research work are linked with the mentor's less directive communication style – the mentor in the role of someone who listens, encourages, poses questions. The mentor has an extremely important role in the career of the beginner researcher, especially in the period when the researcher is in his or her most creative years; Matelič, Mali and Ferligoj (2007) report that the mentor's scientific excellence and his or her attitude towards the person being mentored has an influence on the success of young researchers, and that "imposing an opinion too frequently, directing the course of the project in a way that is too detailed and limiting freedom in the selection of the content of the research reduces, and quite frequently even destroys, creativity, and with this the success of the researcher" (p. 92). From this perspective, given the results of the present study it is possible to conclude that students typically gain quality encouragement for their creative research from their mentors; however, at the same time the presence of certain cases of poor dyadic communication suggests that within the framework of the organisation of postgraduate study it would in the future be sensible to research

the area of the social and organisational components of the study context in more detail (cf. Usher & Parker, 2002) and to encourage these components in a more planned way (Hemlin, Allwood & Martin, 2004). A culture that supports creative processes in a particular scientific research environment contributes significantly to the creativity of research groups, i.e., to the formation of creative interests, to the level and types of creativity (Hennessay, 2006; Yusuf, 2009). In connection with this, Neumann (2009) explains that "the best conditions for scientific creativity come with a free-flowing hierarchy and a highly developed culture of interaction to guarantee the exchange of ideas and inspiration. Furthermore, interdisciplinary interactions lead to the generation of new and unusual ideas. Finally, because of the freedom to try new things, these ideas can be tested and eventually generate new insights." (p. 205).

The question that arises from this discourse reopens the problem of the "architecture" of the existing system of postgraduate study (Zgaga, 2007), particularly with regard to its multitudinousness; this can be an obstacle to quality communication, which can in turn make it more difficult to differentiate between "excellent" and "average" academic products, and especially creative products. As Hermans (2011), the EU Directorate General for Research and Innovation, emphasised at the EU Conference on Talent Support, in the document "Europe 2020 Strategy" emphasis is placed on the responsibility of EU members to encourage the creative and innovative cooperative work of young researchers both on the level of postgraduate study and in the area of their employment, with the goal of strengthening the intellectual and social capital of the EU for sustainable development and for increasing competition in world markets.

The fact is that in contemporary society knowledge, whose key element is creativity, is becoming an increasingly valuable commodity both in the area of research and its products and as well as in the application of knowledge, in the sense of various types and forms of innovation. The academic micro-environment is undoubtedly one of the most important "generators" of creative ideas (Cropley, 2009; Gulbrandsen, 2004; Hollingsworth, 2007), while at the same time being a "sensor" for recognising creative young researchers who are highly sensitive to research problems – they know how to find good research problems, they recognise concealed research problems and they invent new research problems - as well as possessing other personality characteristics (sufficient flexibility, openness, independence, preparedness

to take risks, etc.) that condition creative research and the achievement of scientific results. For this reason, it is critical that the academic institution provide students with a creative environment, offering them mentors who, in addition to research competences in the narrow sense, also encourage students to develop a value system in the context of scientific creativity.

References

Adelson, B. (2003). Issues in scientific creativity: insight, perseverance and personal technique: Profiles of the 2002 Franklin institute laureates. *Journal of Franklin Institute, 340*, 163–189.

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity.* Boulder, CO: Westview Press.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal, 39*, 1154–1184.

Beghetto, R. A., & Kaufman, J. C. (2007). Toward a broader conception of creativity: A case for "mini-c" creativity. *Psychology of Aesthetics, Creativity, and the Arts, 1*, 73–79. doi: 10.1037/1931-3896.1.2.73

Charyton, C., & Snelbecker, G. E. (2007). General, artistic and scientific creativity attributes of engineering and music students. *Creativity research Journal, 19*, 213–225.

Csikszentmihalyi, M. (1991). *Flow: The psychology of optimal experience*. New York, NY: Harper & Row.

Chikszentmihalyi, M. (1999). Implications of a systems perspective for the study of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 313–335). New York, NY: Cambridge University Press.

Collins, R. (2007). The creativity of intellectual networks and the struggle over attention space. In A. Sales, & M. Fournier (Eds.), *Knowledge, communication and creativity* (pp. 156–165). London: Sage.

Craig, L. (1990). A guide to increased creativity in research – inspiration or perspiration? Roundtable. *Bioscience, 40*, 123–129.

Ekvall, G. (1996). Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology, 5*, 105–123.

Flippo, R. F., & Caverly, D. C. (Eds.) (2009). *Handbook of college reading and study strategies research* (2nd ed). New York, NY: Routledge.

Furnham, A., & Bachtiar, V. (2008). Personality and intelligence as predictors of creativity. *Personality and Individual Differences, 45*, 613–617.

Gardner, H. (2003). *Razsežnosti uma: Teorija o več inteligencah*. Ljubljana: Tangram.

Guilford, J. P. (1950). Creativity. *American Psychologist*, 5, 444–454.

Gulbrandsen, M. (2004). Accord or discord? Tensions and creativity in research. In S. Hemlin, C. M. Allwood, & B. R. Martin (Eds.), *Creative knowledge environments: The*

influences on creativity in research and innovation (pp. 31–57). Cheltenham: Edward Elgar.

Heinze, T., Shapira, P., Rogers, J. D., & Senker, J. M. (2009). Organizational and institutional influences on creativity in scientific research. *Research Policy, 38*, 610–623.

Heinze, T., Shapira, P., Senker, J. M., & Kuhlmann, S. (2007). Identifying creative research accomplishments: Methodology and results for nanotechnology and human genetics. *Scientometrics, 70*, 125–152.

Hemlin, S. (2009). Creative knowledge environments: An interview study with members and group leaders of university and industry R&D groups in biotechnology. *Creativity and Innovation management, 18*, 278–285. doi: 10.1111/j.1467-8691.2009.00533.x.

Hemlin, S., Allwood, C. M., & Martin, B. R. (2004). What is creative knowledge environments? In S. Hemlin, C. M. Allwood, & B. R. Martin (Eds.), *Creative knowledge environments: The influences on creativity in research and innovation* (pp. 1–30). Cheltenham: Edward Elgar.

Hennessay, B. A. (2006). Creativity and motivation in the classroom: A social psychological and multi-cultural perspective. In A. G. Tan (Ed.), *Creativity: A handbook for teachers* (pp. 27–46). Singapore: World Scientific.

Hermans, S. (2011). *Creativity and innovation in the EU 2020 strategy*. Plenary speech at Hungarian EU Presidential Conference on Talent Support and First European Talent Day, Budapest, 7.-9.4.2011.

Hunter, S. T., Bedell, K. E., & Mumford, M. D. (2007). Climate for creativity: A quantitative review. *Creativity Research Journal, 19*, 69–90.

L'Abate, L., DeGiacomo, P., Capitelli, M., & Longo, S. (Eds.) (2009). *Science, mind and creativity: The Bari symposium*. New York, NY: Nova Science Publishers.

Leong, F. T. L., & Pfaltzgraff, R. E. (1996). Finding the research topic. In F. T. L. Leong, & J. T. Austin (Eds.), *The psychology research handbook: A guide for graduate students and research assistants* (pp. 3–17). Thousand Oaks, CA: Sage.

Levin, B. B. (2008). *Case studies of teacher development: An in-depth look at how thinking about pedagogy develops over time*. Taylor & Francis e-Library.

Makel, M. C., & Plucker, J. A. (2008). Creativity. In S. I. Pfeiffer (Ed.), *Handbook of giftedness in children: Psychoeducational theory, research, and best practices* (pp. 247–270). New York, NY: Springer.

Matelič, U., Mali, F., & Ferligoj, A. (2007). Kreativno okolje in uspešnost mladih raziskovalcev. *Družboslovne razprave, 23*, 71–94.

Miller, A. I. (2000). *Insights of genius: Imagery and creativity in science and art*. New York, NY: First MIT Press.

Neumann, C. J. (2009). Fostering creativity: A model for developing a culture of collective creativity in science. *EMBO reports,* 8, 202–206.

Ochse, R. (1990). *Before the gates of excellence. The determination of creative genius.* Cambridge: Cambridge University Press.

Pečjak, V. (1987). *Misliti, delati, živeti ustvarjalno*. Ljubljana: Državna založba Slovenije.

Plucker, J., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist*, *39*, 83–96. doi: 10.1207/s15326985ep3902_1

Runco, M. (2004). Creativity. *Annual Review of Psychology, 55*, 657–687.

Sawyer, R. K. (2006). *Explaining creativity: The science of human innovation*. New York, NY: Oxford University Press.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54–67.

Simonton, D. K. (2003). Scientific creativity as constrained stochastic behaviour: The integration of product, person, and process perspectives. *Psychological Bulletin, 129*, 475–494. doi: 10.1037/0033-2909.129.4.475

Simonton, D. K. (2004). *Creativity in science: Chance, logic, genius, and zeitgeist*. Cambridge: Cambridge University Press.

Soler, J. M. (2007). A rational indicator of scientific creativity. *Journal of Infometrics, 1*, 123–130.

Stehr, N. (1994). *Knowledge Societies.* Sage: London.

Sternberg, R. J. (2003). *Wisdom, intelligence, and creativity synthesized*. Cambridge: Cambridge University Press.

Sternberg, R. J., & Lubart, T. I. (1996). Investing in creativity. *American Psychologist*, 51, 677–688.

Sternberg, R. J., & Lubard, T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 3–15). Cambridge: Cambridge University Press.

Unsworth, K. L., & Parker, S. K. (2002). Promoting a pro-active and innovative workforce for the new workplace. In D. Holman, T.D. Wall, C. W. Clegg, P. Sparrow, & A. Howard (Eds.), *The New Workplace: A Guide to the Human Impact of Modern Work Practices* (pp. 175–196). Chichester: John Wiley & Sons.

Urban, K. K. (2007). Assessing creativity: A componential model. In A. G. Tan (Ed.), *Creativity: A handbook for teachers* (pp. 167–186). Singapore: World Scientific.

Weisberg, R. W. (1993). *Creativity: Beyond the myth of genius*. New York, NY: Freeman and Company.

Zgaga, P. (2007). »Bolonjska arhitektura« doktorskega študija? Nekatere ključne teme v novejših razpravah o doktorskem študiju v Evropi. *Vestnik – Univerza v Ljubljani, 38,* 3–7.

Yusuf, S. (2009). From creativity to innovation. *Technology and Society, 31*, 1–8. doi: 10.1016/j.techsoc.2008.10.007

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Personal and Emotional Factors in the Labour Integration of University Graduates in the Field of Education. Implications for University Teaching.

Juan L. Castejón*[1], Raquel Gilar[2] and Pablo Miñano[3]

The main aim of this paper is to analyse the role of intellectual, personal and emotional competencies as well as technical knowledge - academic achievement - in the employment of university graduates, with the purpose of incorporating these competencies into training programmes developed within the European Framework of Higher Education. This study is based on an initial sample of 118 university graduates in the field of education. We have gathered information about academic achievement and the intellectual, personal and emotional traits of this sample. From these data, and given the importance of non-intellectual aspects of intelligence associated with professional success, the specific contribution -incremental validity - of personal and emotional intelligence in explaining the employment - labour integration - of university graduates in the field of education is studied. From this point onwards, we attempt to identify the key socio-emotional competencies in the field of education in order to establish the implications of including this type of skills in university training programmes within the European Higher Education Area.

Key words: Emotional intelligence, Labour integration, Personality, University education of teachers

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Introduction

The main objective of this research project is to analyse the role that intellectual, personal and emotional traits play in predicting and explaining integration into the labour market of university graduates from Departments of Education, while also establishing the implications of including personal and emotional competencies in university academic curricula (Ayers & Stone, 1999; Fallows & Steven, 2000; Hettich, 2000; Jaeger, 2003). The personal and socio-emotional factors included in this study are very similar to several of the generic competencies established within the European Higher Education Area (European Education Council, 2006; Gonzalez & Wagenaar, 2003).

Traditionally, academic intelligence is associated with general or analytical intelligence as defined in psychometric terms, such as IQ (Sternberg, 2003; Sternberg, Castejón, Prieto, Hautamäki & Grigorenko, 2001; Sternberg, Prieto & Castejón, 2000). Meanwhile, social intelligence is a broad construct with less easily defined boundaries, and which in scientific literature is in some cases linked to emotional intelligence (Bar-On, 2000; Goleman, 1998) and in others to practical intelligence (Hendlund & Sternberg, 2000). Likewise, the definition of emotional intelligence includes two different conceptions (Bar-On, 2000; Mayer, Roberts & Barsade, 2008). One broad conceptualisation considers emotional intelligence as a combination of attributes that are intimately tied to personality but different from IQ and related to competencies underlying academic and professional performance (Bar-On, 2000; Goleman, 1995, 1998). Another more restrictive conceptualisation considers it as the ability to perceive and understand emotion-related information (Mayer, Caruso & Salovey, 2000).

Skills inherent to socioemotional intelligence, once correlated to performance in the professional realm, have been considered as competency models (Boyatzis, 1999; Boyatzis, Goleman & Rhee, 2000). In particular, mixed models of emotional intelligence bring together broad competencies of a socioemotional nature (Mayer, Salovey & Caruso, 2000b). Furthermore, most professional competencies identified as key competencies for professional performance comprise, or are closely related to, aspects under study in the field of emotional intelligence.

Research on emotional intelligence (Bar-On, 2000; Goleman, 1997, 2001; Mayer, Roberts & Barsade, 2008) traditionally emphasises the value of non-intellectual factors in predicting/explaining academic

and professional achievement. Some authors even pose the hypothesis that individual academic qualifications are less important than personal factors as grades are a condition common to a large group, whilst what increases opportunities for employment is a compendium of attitude-based competencies and social skills concerning work (Mora, 1997; Planas et al., 2000), in addition to continued training. In this regard, García-Aracil and Van der Velden (2008) find that graduates with more professional competencies have higher incomes and greater levels of satisfaction with their employment.

Cognitive abilities are especially important in the workplace, particularly when one's job is more complex (Gottfredson, 2003), whereas emotional competencies are considered critical to effective performance in most types of jobs (Cherniss, 2000), as well as in relation to labour integration and employability (Palací & Topa, 2002; Palací & Moriano, 2003).

Socioemotional competencies are highly valued in the labour market. Most jobs do not merely require technical knowledge and skills, but also a certain level of socioemotional competencies. Cherniss (2000) points out that a major part of investment by American companies in training targets social and emotional abilities. A national survey carried out with American employers concluded that six of seven competencies key to professional success are inherent to emotional intelligence (Ayers & Stone, 1999; Goleman, 1998). Nevertheless, most universities fail to include these competencies in their syllabi (Boyatzis et al., 1995; Echeverría, 2002).

Although these competencies do not exclusively predict or explain professional performance (Schmidt & Hunter, 1998), emotional competencies seem to have an explanatory power that goes beyond other variables (Goleman, 1998). These competencies affect important aspects of one's professional career, such as labour integration or employability (Fallows & Steven, 2000; Hettich, 2000).

Despite the importance attributed to some inherently non-intellectual aspects, such as personality and emotional intelligence, in academic and professional achievement as well as professional development in general (Coté & Miners, 2006; Dulewicz, Higgs & Slaski, 2003; Lopes et al., 2006; Pérez & Castejón, 2007), greater empirical evidence is required regarding this relationship, as the influence of these variables is not always evident (Barchard, 2003; Brackett & Mayer, 2003; Zeidner, Mathews & Roberts, 2004). Likewise, well-designed studies that control variables traditionally considered to be important - such

as variables related to personality, intellect, and technical knowledge (Davies, Stankov & Roberts, 1998; Sternberg, 2003) - are necessary to detect the contribution of these factors to the labour integration of university graduates. Therefore, the incremental validity of personal and emotional factors must be defined in order to predict a given criteria - in this case, labour integration - beyond the contribution made by measurements of general intelligence and acquired technical know-how (Amelang & Steinmayer, 2006; Bastian, Burns & Nettelbeck, 2005; Brackett & Mayer, 2003; Van-der-Zee, Thijs & Schakel, 2002).

In addition, it is necessary to establish the general or specific nature of different aspects of non-academic intelligence for the purpose of identifying either general factors shared across different professional fields or specific components of personality and emotional intelligence associated with achievement within each profession (Boyatzis, 2008; Boyatzis, Goleman & Rhee, 2000).

In the field of teaching, a positive relationship is found between emotional intelligence and teachers' personal adjustment and wellbeing (Palomera, Fernández-Berrocal & Brackett, 2008). Studies analysing the relationship between emotional intelligence and burnout in secondary level education teachers (Chan, 2006) show how burnout negatively influences teacher wellbeing (Vanderberghe & Huberman, 1999) and teacher-student interpersonal relationships (Yoon, 2002).

Jennings and Greenberg (2009), as well as Sutton and Wheatly (2003), reveal the close relationship between a teacher's socioemotional competencies and effectiveness/quality during teaching-learning processes, as well as the development of students' prosocial behaviour in the classroom. Di Fabio and Pazazzeschi (2008) evaluate the relationship between emotional intelligence and self-efficacy in a sample of Italian professors. Chan (2008) carries out a similar study to consider the relationships between the emotional intelligence, self-efficacy and ability to cope of teachers in Hong Kong. In Spain, the study on perceived emotional intelligence and life satisfaction among university teachers carried out by Landa, López-Zafra, Martínez, and Pulido (2006) is worth mentioning.

Weare and Grey (2003) conclude with recommendations for teacher-training organisations to explicitly develop personal and socioemotional competencies, based on the premises that it is impossible either to teach a competency one does not possess or to offer quality teaching in the absence of personal wellbeing.

Given the above, the specific objectives of this project are: a)

to develop a predictive model that includes traits related to intelligence, personality, emotional intelligence and knowledge/academic achievement as explanatory variables for the labour integration of university graduates from Departments of Education; b) to evaluate the predictive value of non-intellectual factors, personality and emotional intelligence in predicting labour integration once the effect of intellectual variables, such as intelligence and academic performance, are controlled; and c) to establish implications for developing personal and emotional competencies within university syllabi in the European Higher Education Area.

Method

Participants

The initial sample consisted of 118 undergraduates studying for a degree (Teaching in Preschool, Primary and Secondary Education) at the Department of Education of the University of Alicante, Spain. The students ranged in age from 20 to 35, with a mean age of 22.61 years. Males represented 26.2% and females 73.8% of the sample.

Instruments

The following instruments were used to assess the variables analysed in this study.

The *test of g factor Scale 3* by Cattell and Cattell, for group-administered testing, composed of 4 subtests which include incomplete and progressive series for testing cognitive abilities of identification, perceived similarities, seriation, classification, matrices and comparisons, was used to obtain the IQs of all the participants sampled. G-factor saturation was high, around 0.90.

The *NEO Five-Factor Inventory (NEO-FFI)* by Costa and McCrae (1992), Spanish language adaptation by TEA Ediciones in 2002. This instrument evaluates five major personality factors and offers an abridged version for measuring the following dimensions: Neuroticism, Extraversion, Openness to experience, Agreeableness, and Conscientiousness or Responsibility. The test is composed of 60 items with response options ranging from A (Strongly Disagree) to E (Strongly Agree). Reliability of internal consistency in the development and validation of the questionnaire is shown by values ranging between .86 and .95, with test-retest reliability values ranging between .70 and .92 for the Spanish sample, in addition to factorial validity.

The *Trait Meta-Mood Scale-24* (TMMS-24) is a version of TMMS-48 (developed by Salovey and Mayer) adapted and shortened by Fernández-Berrocal, Extremera and Ramos (2004). This self-report measure assesses three key dimensions of emotional intelligence: emotional attention, emotional clarity, and repair/emotional control. The subjects were asked to evaluate the degree to which they agreed with each item on a Likert-type scale of 5 points (1 = Strongly Disagree, 5 = Strongly Agree). After having been shortened, the scale showed increased reliability in all of its factors: Attention (.90), Clarity (.90), and Repair/Control (.86).

The *Self Report Inventory* (SSRI) from Schutte et al. (1998) adapted by Chico (1999), who evaluated the scale's psychometric properties and concluded that these were adequate. This Likert-type scale (1= Strongly Disagree; 5= Strongly Agree) is composed of 33 items, 13 of which refer to the *appraisal and expression* of emotions, 10 to the *regulation* of emotions, and the remaining 10 to the *utilisation* of emotional information. Therefore, this test includes the three factors proposed by Mayer and Salovey in 1990.

For the variable of academic performance, average grades obtained during university studies expressed in a scale of 1 to 10 points were used. The University of Alicante provided information these grades upon prior consent granted by the participants and authorisation given by the university academic authority.

In order to gather information on employment, the participants completed a questionnaire on whether they were employed or unemployed and the number of months they had been employed since graduation.

Procedure

Data collection was executed in two phases. The first phase was carried out when the participants were in their final year of university studies, and the second phase was conducted two years after the participants had completed their studies.

During the first phase, participants were selected using a stratified random sampling process proportional to the number of students enrolled in the aforementioned degree courses. The study was carried out with a representative sample of students in their final year of their degree. Upon completion of the selection procedure, the chosen scales were applied. The scales were distributed in class during the academic year, according to the instructions given in their corresponding

manuals. Students were given approximately two hours to complete the scales during a single session. Scale administration was carried out using the following procedure: first, a presentation letter was distributed and an oral presentation of research objectives was given. The participants gave their written consent and committed to facilitating the information required for the study. Then, the different questionnaires were administered in the following order: Cattell test of g factor, NEO-FFI, TMMS-24 and SSRI. The participants' grades were obtained once the academic year had finished.

During the second phase, information on participants' employment was collected via a questionnaire sent both by email and by post.

Design and data analysis

Correlation and multiple regression techniques were used to analyse the data, using the hierarchical regression procedure.

A series of multiple regression analyses were performed, using the number of months employed as a criterion in order to ascertain the predictive value of the variables concerning labour integration considered in the project (analysed in accordance with data regarding the number of months employed since graduation). In this type of analysis, the variables that are first entered into the equation are attributed with all of the variance. Thus, the variables that are entered first act as covariants of those which are subsequently included. In this way, the effect of the first on the second may be partitioned. The only variable that can contribute on its own to the explanation of the criterion is the last one to be introduced. Thus, an overestimation of the predictive value of variables entering the equation first is obtained, which is why the decision to initially introduce certain variables before others was made on a theoretical basis.

Apart from the possibility of examining the unique contribution of the variables or groups of variables subsequently introduced into the equation through a hierarchical regression analysis, it is possible to detect whether there is a significant increase in the explained variance of the criterion each time a variable, or block of variables, is inserted into the equation.

Data analysis was completed using the SPSS Version 18 statistical package licensed to the University of Alicante.

Results

Results of the correlation analysis

Table 1 shows existing correlations between the different variables included in the study.

As expected, emotional factors correlate with one another. The neuroticism personality factor also had a significantly negative correlation with the regulation of emotions (r = -.435). Likewise, the extraversion personality factor also had a very significant correlation with the emotional factors of emotional clarity (r = .432), emotional control (r = .366), expression of emotions (r = .598), regulation of emotions (r = .668) and use of emotions (r = .416). There are also very significant correlations between the responsibility personality factor and the use of emotions (r = .419).

Finally, it is worth highlighting that variables having a significant correlation with the variable of labour integration are the neuroticism personality factor (r = .296), openness to experience (r = .283), and conscientiousness/responsibility (r = .383), as well as the factor attention to emotions (r = .349).

Table 1. Intercorrelations between variables

	General Intelligence	NEO- Neuroticism	NEO- Extraversion	NEO- Openness	NEO- Agreeableness	NEO- Responsibility	TMMS- Attention	TMMS- Clarity	TMMS- Repair/ Control	SCHUTTE- Expression	SCHUTTE- Regulation	SCHUTTE- Utilization	Mean of Academic Achievement	Labour integration
General Intelligence	1,000													
NEO- Neuroticism	,036	1,000					(n=118)							
NEO- Extraversion	,192	-,143	1,000											
NEO- Openness	-,133	,276*	,055	1,000										
NEO- Agreeableness	-,246	-,198	-,180	-,126	1,000									
NEO- Responsibility	,108	,020	,294*	-,140	,077	1,000								
TMMS- Attention	-,008	,292*	,050	-,106	,179	-,235	1,000							
TMMS- Clarity	-,230	-,120	,432**	,039	,152	,044	,393**	1,000						
TMMS- Repair/Control	,183	-,279*	,366**	,270*	,203	-,103	,216	,511**	1,000					
SCHUTTE- Expression	-,182	-,275*	,598**	-,107	,327*	,273*	,195	,546**	,272*	1,000				
SCHUTTE- Regulation	-,231	-,435**	,668**	-,054	,160	,248	,118	,668**	,494**	,714**	1,000			
SCHUTTE- Utilisation	-,206	,004	,416**	,252	,213	,419**	,019	,573**	,468**	,451**	,666**	1,000		
Mean of Academic Achievement	-,005	-,064	-,259	-,028	-,160	-,143	,163	,144	,091	-,169	-,043	-,168	1,000	
Labour integration	-,052	,296*	-,023	,283*	-,076	,383**	,349**	,107	,108	-,033	-,139	,245	,182	1,000
Mean	25.66	33.07	44.82	42.36	44.71	45.82	25.75	26.18	28.50	58.71	43.21	28.46	6.9481	25.5862
SD	4.002	8.130	7.125	5.368	5.846	5.878	5.992	6.473	6.069	5.789	5.555	3.885	1.495	13.645

*p < .05 two-tailed

**p < .005 two-tailed

Results of the hierarchical multiple regression analysis

First, after evaluating the suppositions of the multiple regression analysis we may conclude that our data adapt to the suppositions of the multiple regression analysis. They satisfy the requirements of normality, linearity and homogeneity of variance, as well as independence of errors.

The supposition of normality underlying the multivariate distribution of the variables was verified when comparing the distribution observed of the residuals with that expected under the supposition of normality. The result was that the standardised scores of the residuals were distributed along a straight diagonal line, indicative of the normality of the joint distribution of the variables.

The suppositions of linearity and homogeneity of variance were verified by observing the scatter diagram in which the residuals were projected against the predicted values, which showed the residuals distributed at random around the centre of the diagram. Furthermore, no value is positioned outside the expected results (outlier).

The Durbin-Watson test is used to test the supposition of error independence. The value of the Durbin-Watson statistical D for our data was of 2.368, whereby we consider that this supposition is also verified.

Table 2 shows the results of the hierarchical regression analysis in which blocks of variables relating to intelligence, personality, emotional intelligence and academic achievement, as well as the variable relating to labour integration (months employed) as criterion, are introduced successively.

Table 2. Summary of the hierarchical regression analysis for variables predictive of labour integration (N = 50)

Variables		**B**	**Std. Error**	β
Step 1	General Intelligence	.191	.321	.086
Step 2	General Intelligence	.093	.303	.042
	NEO- Neuroticism	.178	.147	.160
	NEO- Extraversion	-.132	.197	-.093
	NEO- Openness	.430	.227	.249
	NEO- Agreeableness	-.178	.213	-.112
	NEO- Conscientiousness/ Responsibility	.772	.201	.502**
Step 3	General Intelligence	-.433	.537	-.194
	NEO- Neuroticism	-.289	.215	-.260
	NEO- Extraversion	.106	.304	.075
	NEO- Openness	.380	.265	.220
	NEO- Agreeableness	-.498	.258	-.314
	NEO- Responsibility	.869	.281	.565**
	TMMS- Attention	.729	.258	.463**
	TMMS- Clarity	-.150	.266	-.105
	TMMS- Repair/Control	.145	.406	.092
	SCHUTTE- Expression	.299	.314	.174
	SCHUTTE- Regulation	-1,317	.551	-.752*
	SCHUTTE- Utilisation	1.071	.602	.437
Step 4	General Intelligence	-.399	.465	-.179
	NEO- Neuroticism	-.309	.187	-.277
	NEO- Extraversion	.496	.284	.349
	NEO- Openness	.263	.232	.152
	NEO- Agreeableness	-.256	.233	-.162
	NEO- Responsibility	.629	.252	.409*
	TMMS- Attention	.617	.226	.392*
	TMMS- Clarity	-.433	.243	-.304
	TMMS- Repair/Control	-.093	.357	-.059
	SCHUTTE- Expression	.407	.274	.237
	SCHUTTE- Regulation	-1,566	.482	-.894**
	SCHUTTE- Utilisation	1,785	.556	.728**
	Mean of Academic Achievement	2.741	.749	.465**

Note. $R^2 = .007$ step 1; $\Delta R^2 = .339$ step 2; $\Delta R^2 = .160$ step 3; $\Delta R^2 = .140$ step 4 (ps < .002)

*p < .05

**p < .005

Firstly, the block of intellectual skills is entered into the equation. The contribution of this block is not significant ($F = .357$, $p = .553$). The inclusion of the second block of variables relative to the personality trait presuppose a significant increase in the explained variance ($F = 3.793$, $p = .004$). When the third step includes variables relating to emotional intelligence a significant increase of the explained variance is obtained ($F = 3.158$, $p = .004$). In the last step, when the variable of academic achievement is included a significant increase of the explained variance is, in fact, obtained ($F = 4.922$, $p = .000$).

Therefore, once the effect of the previously introduced variables has been controlled, the blocks of variables that prove to contribute most significantly to the explanation of learning processes are those measurements relating to personality traits, emotional intelligence and academic achievement.

The variables that specifically and significantly contribute to explaining the criterion are responsibility ($\beta = .409$, $p = .017$), emotional attention ($\beta = .392$, $p = .010$), regulation of emotions ($\beta = -.894$, $p = .002$) negatively correlated, the use of emotions ($\beta = .728$, $p = .003$) and average grades obtained during university studies ($\beta = .465$, $p = .001$).

Taken as a whole, these variables contribute significantly to explaining labour integration and account for 64% of the variance in the criteria.

Discussion

Given these results, variables that are significantly related to or contribute to explaining labour integration - time in months of employment - of university graduates from Departments of Education are centred upon personality-related aspects, emotional intelligence and academic performance, particularly the factors of responsibility (NEO), attention to emotions (TMMS), regulation of emotions (SSRI) negatively correlated, use of emotions (SSRI) and academic performance.

The highest percentage of the explained variance of labour integration is attributed to personal and emotional variables (50%), while general intelligence explains an insignificant percentage (.07%) and acquired knowledge - mean academic performance - does so for 14%.

Explained more clearly, university graduates in the field of education who find work earlier, i.e., have been employed longer since

graduation, have a greater sense of responsibility, pay more attention to their emotions and, despite having less control over them, they put their emotions to better use. Finally, their academic performance is higher.

Although these results reveal that professional achievement (labour integration in this case) of teachers is partially predicted or explained by technical competencies as evidenced by academic performance, greater explanatory power is attributed to emotional competencies, as revealed in other studies (Goleman, 1998; Hettich, 2000). However, contrary to the findings of different authors (Schmidt & Hunter, 1998), other factors, such as general intelligence, fail to have a significant effect.

Therefore, it seems clear that several personality-related factors and emotional intelligence are linked to professional achievement - or with an aspect of this, such as labour integration - of teachers. This provides another reason, along with the existing relationship between socioemotional competencies and efficacy in teaching (Chan, 2008; Di Fabio & Pazazzeschi, 2008; Jennings & Greenberg, 2009; Sutton & Wheatly, 2003), for teacher training institutions to foster the development of personal and socioemotional competencies (Weare & Grey, 2003).

Research is being carried out in the European Higher Education Area for the purpose of identifying key competencies for university graduates as well as the role played by these competencies in labour integration. The implementation of the Bologna Declaration of 1999 for creating the European Higher Education Area resulted in specific proposals for competency-based design and development of educational syllabi and university curricula, such as the *Tuning Educational Structures in Europe* project (González & Wagenaar, 2003), which proposes a series of generic competencies, mostly overlapping with the personal and socioemotional competencies studied under the umbrella term of socioemotional intelligence. However, the project's conclusions leave unanswered questions as to "*whether these competencies are shared or specific, how they are to be identified, how to integrate them within university curricula or foster their development in higher education*" (Gonzalez & Wagenaar, 2003, p. 40). One of the proposals presented by companies in order to transfer these results to training programmes is to integrate specific training on professional competencies and skills within courses included in university curricula. Companies and, in general, both public and private organisations, demand highly qualified professionals trained in all aspects of the individual, and the

university must be able to satisfy this need (Campos, 2008).

Another proposal centred on generic competencies is included in the 2005 DeSeCo (Definition and Selection of Competencies) Project Report, a project sponsored by the Organisation for Economic Co-operation and Development (OECD, 2005). Three main types of competencies related to the following are considered: a) the use of new technologies, b) interpersonal skills and the ability to work as a member of a group, and c) the capacity to work independently.

In 2005, the European Parliament approved a recommendation for Member States to develop a series of generic competencies in the European Higher Education Area (Education Council, 2006). These eight key competencies are considered to be essential skills, knowledge and attitudes that every European should have in order to prosper in a knowledge-based society. Of the eight key competencies, four are personal and/or socioemotional in nature: a) learning to learn; b) interpersonal, intercultural and social competencies, and civic competence; c) entrepreneurship; and d) cultural expression.

In addition, within the European Union 6th Framework Programme (FP6), the main objective of a Spanish research project entitled "The Flexible Professional in the Knowledge Society: New Demands on Higher Education in Europe" or REFLEX (ANECA, 2007), is to analyse and diagnose the labour integration of university graduates. The project's goal is to respond to a number of general questions concerning: the competencies required of university graduates for their integration into the knowledge society; the role universities play in developing these competencies; the degree to which graduate expectations are fulfilled regarding employment and ways to resolve the imbalance between graduate expectations and the characteristics of their jobs.

Therefore, it is necessary to make progress towards new proposals for integrating and developing these competencies in the higher education curricula, such as those put forward in the book edited by Fallows and Steven (2000), and other perspectives from the United States and Canada presented by Boyatzis, Cowen, and Kolb (1995) and Boyatzis, Wheeler and Wright (2001). Moreover, some current study plans and university curricula implement these competencies, such as several Australian universities (Nunan, George & McCausland, 2000), the American Harvard Business School (Jaeger, 2003; Prahalad & Hamel, 1990) or the English Sheffield Hallam University, to name a few.

Despite the importance given to emotional intelligence in the

educational context for developing the professional activity of teachers, very few syllabi actually focus on teacher training. Numerous researchers have pointed out the need for even basic teacher training to include the development of emotional intelligence as part of the generic competencies proposed by the European Higher Education Area (Bisquerra, 2005; Bueno, Teruel & Valero, 2005; Extremera & Fernández-Berrocal, 2004; Pesquero, Sánchez, González & Martín, 2008; Teruel, 2000). Despite clear evidence, in some cases, that training novice teachers in emotional competencies has proven to be effective not only in increasing their own emotional competencies but also for predicting a smooth transition from their role as a student to that of a professional teacher (Byron, 2001), specific proposals are still needed as to how to include these competencies in teacher education. Pug's (2008) study conducted in a primary school concludes that higher education programmes and partner schools would benefit from time, curriculum provision and government agency support to recognise, reflect upon and develop emotional intelligence in teaching.

Specific emotional knowledge and skills should become part of the teacher education curriculum to better prepare pre-service teachers in the affective domain (Kassem, 2002). Cohen (2001) suggests that teacher education program need address: 1. the role of emotion in learning and in creating; 2. emotional "decoding" skills; and 3. ways of use decoding emotions to solve real-life, social-emotional problems. Methods for implementing socio-emotional curriculum in teacher education fall along a continuum. Curriculum changes could be implemented by the addition of standalone courses on socio-emotional content or by the integration of emotional components into the current curriculum, through the use of such common tools as case studies and cooperative learning. Cohen's (2001) compilation of practices in the United States provides research evidence regarding certain successful methods.

Some recommendations for developing these competencies in higher educational programmes are referenced to competencies proposed in the Tuning project (González & Wagenaar, 2003), which to a great extent have been adopted in the European Higher Education Area, most of which are upheld by the DeSeCo Project (OECD, 2005) as well as the European Education Council (2006). For example, academics could introduce teamwork (Koman & Wolff, 2008) to help students develop interpersonal relationships with other group members, along with self-awareness and their capacity to empathise with others.

The ability for criticism and self-criticism may be developed through immediate and accurate feedback given by the teacher on one's projects (homework, examinations, etc.). The skill for working autonomously may be fostered through independent tasks that require informational searches while laying the foundations for lifelong learning. Practicums outside of the academic realm, carried out in businesses or organisations - such as those which students complete in educational centres - may strengthen the integration of knowledge, the application of knowledge in practice, interpersonal relations, initiative, assertiveness, adaptation to new situations, etc. The ability to deal with differences and contradictions is found in many of the educational sector's lists of key competencies. A complex world demands that we do not necessarily dash towards a single answer or an either/or solution, but rather favour creativity in managing tensions inherent to the diversity of circumstances.

Finally, our study generated some unexpected results that deserve more attention: firstly, the negative correlation that exists between emotional regulation and employability, which is difficult to explain in this context, unless it is taken to mean that emotional regulation implies the existence of negative emotions which might not be present in the most employable graduates. Meanwhile, the use of one's own emotions is seen to be positive; secondly, the low correlation of academic achievement with employability that may be explained by the fact that technical knowledge - represented by academic performance - plays a lesser role during initial employment when compared with professional teaching experience; and thirdly, the no correlation of intelligence with academic achievement, also detected in studies on engineering graduates (Pérez & Castejón, 2007), that may be explained by the effect of the restricted range of intellectual capacity of a selected sample of university graduates, where levels are expected to be mid to high. Alternately, this may also be attributed to the inability of academic performance-related criteria to reflect deeper aspects of thinking or intellectual capacity, at least within the scope of university teacher training, which would be even more problematic.

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References

Agencia Nacional de Evaluación de la Calidad y Acreditación (ANECA, 2007). *Project Reflex. Executive Report*. June 2007. Spanish Ministry of Education.

Amelang, M., & Steinmayr (2006). Is there a validity increment for tests of emotional intelligence in explaining the variance of performance criteria? *Intelligence*, *34*, 459-468.

Ayers, D., & Stone, B. (1999). Extension organization of the future: Linking emotional intelligence and core competencies. *Journal of Extension*, 37(6). Retreived from http://joe.org/joe/1999december/iw4.html.

Barchard, K. (2003). Does emotional intelligence assist in the prediction of academic success? *Educational and Psychological Measurement*, *63*(5), 840-858.

Bar-On, R. (2000). Emotional and social intelligence: Insights from the Emotional Quotient Inventory (EQ-i). In R. Bar-On and J. D. A. Parker (Eds.), *The handbook of emotional intelligence: Theory, development, assessment, and application at home, school, and in the workplace* (pp. 363-387). San Francisco, CA: Jossey-Bass Inc.

Bastian, V.A., Burns, N. R., & Nettelbeck, T. (2005). Emotional intelligence predicts life skills, but not as well as personality and cognitive abilities. *Personality and Individual Differences*, *39*, 1135-1145.

Bisquerra, R. (2005). La educación emocional en la formación del profesorado [Education on emotions in teacher training]. *Revista Interuniversitaria de Formación del Profesorado, 19*(3), 95-114.

Boyatzis, R. E. (2008). Competencies in the 21st century. *Journal of Management Development*, *27*(1), 5-12.

Boyatzis, R. E. (1999). Self-directed change and learning as a necessary meta-competency for success and effectiveness in the 21st century. In R. Sims & J. G. Veres (Eds.), *Keys to employee success in the coming decades* (pp. 15-32). Westport: Greenwood.

Boyatzis, R. E., Cowen, S. S., & Kolb, D. A. (Eds.), (1995). *Innovation in professional education: Steps on a journey from teaching to learning*. San Francisco: Jossey-Bass.

Boyatzis, R., Goleman, D., & Rhee, K. (2000). Clustering competence in emotional intelligence. Insights from the emotional competence inventory (ECI). In R. Bar-On & J. D. A. Parker (Eds.), *Handbook of emotional intelligence* (pp. 343-367). San Francisco: Jossey-Bass.

Boyatzis, R. E., Wheeler, J., & Wright, R. (2001). Competency development in graduate education: A longitudinal perspective. In *Proceedings of the First World Conference on Self-Directed Learning*. Montreal: GIRAT.

Brackett, M., & Mayer, J. D. (2003). Convergent, discriminant, and incremental validity of competing measures of emotional intelligence. *Personality and Social Psychology Bulletin*, *29*(9), 1147-1158.

Bueno, C., Teruel, M. P., & Valero, A. (2005). La inteligencia emocional en alumnos de Magisterio: La percepción y comprensión de los sentimientos y las emociones [Emotional intelligence in students of teaching. The perception and comprehension of feelings and

emotions]. *Revista Interuniversitaria de Formación del Profesorado*, *19*(3), 169-194.

Campos, M. C. (2008). Los egresados y su situación laboral ¿estudias o trabajas [Graduates and their employment status: Do you work or study?]. *Revista Fuentes*, *8*, 1-11.

Cattell, R. B. & Cattell, A. K. (1963). Test of g: Culture fair, Scale (Champaign, III: Institute for Personality and Ability Testing (Spanish adaptation by TEA Editions, 2002).

Chan, D. W. (2006). Emotional Intelligence components and burnout among Chinese secondary school teachers in Hong Kong. *Teaching and Teacher Education*, *22*(8), 1042-1054.

Chan, D. W. (2008). Emotional intelligence, self-efficacy, and coping among Chinese prospective and in-service teachers in Hong Kong. *Educational Psychology*, *28*(4), 397-408.

Cherniss, C. (2000). Social and Emotional Competence in the workplace. In R. Bar-On & J. D. Parker (Eds.), *The handbook of emotional intelligence* (pp.453-458). San Francisco: Jossey-Bass.

Chico, E. (1999). Evaluación psicométrica de una escala de inteligencia emocional [Psychometric evaluation of an emotional intelligence scale]. *Boletín de Psicología*, *62*, 65-78.

Cohen, J. (Ed.) (2001). *Caring classrooms/intelligent schools: the social emotional education of young children*. New Tork: Teachers College Press.

Costa, P. T., Jr., & McCrae, R. R. (1992). *NEO PI-R, Professional Manual. Revised NEO Personality Inventory (NEO PI-R) and NEO Five Factor Inventory (NEO-FFI).* Odessa, FL: Psychological Assessment Resources.

Coté, S., & Miners, CTH. (2006). Emotional intelligence, cognitive intelligence and job performance. *Administration Science Quarterly*, *51*, 1-28.

Davies, M., Stankov, L., & Roberts, R. D. (1998). Emotional intelligence. In: search of an elusive construct. *Journal of Personality and Social Psychology*, *75*, 989-1015.

Di Fabio, A. & Palazzeschi, L. (2008). Emotional intelligence and self-efficacy in a sample of Italian high school teachers. *Social Behavior and Personality*, *36*(3), 315-325.

Dulewicz, V., Higgs, M., & Slaski, M. (2003). Measuring emotional intelligence: content, construct and criterion-related validity. *Journal of Managerial Psychology*, *18*(5), 405-420.

Echeverría, B. (2002). Gestión de la competencia de acción profesional [Managing competencies in professional practice]. *Revista de Investigación Educativa*, *20*(1), 7-42.

Education Council (2006). *Recommendation of the European Parliament and the Council of 18 December 2006 on key competencies for lifelong learning.* Brussels: Official Journal of the European Union, 30. 12. 2006.

Extremera, N., & Fernández-Berrocal, P. (2004). La importancia de desarrollar la inteligencia emocional en el profesorado [The importance of developing emotional intelligence in teachers]. *Revista Iberoamericana de Educación, 33*(8). Retreived form http://www.campus-oei.org/revista/deloslectores/759Extremera.PDF.

Fallows, S., & Steven, C. (Eds.) (2000). *Integrating key skills in higher education: employability, transferable skills and learning for life.* London: Kogan Page.

Fernández-Berrocal, P., Extremera, N., & Ramos, N. (2004). Validity and reliability of the Spanish modified version of the Trait Meta-Mood Scale (TMMS-24). *Psychological Report*, *94*, 751-755.

García-Aracil, A., & Van der Velden, R. (2008). Competencies for young European higher education graduates: labour market mismatches and their payoffs. *Higher Education*, *55*(2), 219-239.

Goleman, D. (1995). *Emotional Intelligence*. New York: Bantam Books, Inc.

Goleman, D. (1998). *Working with emotional intelligence*. Santa Ana: Books on Tape, Inc.

Goleman, D. (2001). Emotional intelligence perspectives on a theory of performance. In C. Cherniss, & D. Goleman (Eds.), *The emotionally intelligent workplace* (pp. 27-44). San Francisco: Jossey-Bass.

González, J., & Wagenaar, R. (2003). *Tuning Educational Structures in Europe. Final Report. Phase One*. Bilbao: Universidad de Deusto.

Gottfredson, L. S. (2003). Jobs and Life. In H. Nyborg (Ed.), *The Scientific Study of General Intelligence* (pp. 293-342). Oxford: Elsevier Science/Pergamon.

Hedlund, J., & Sternberg, RJ. (2000). Too many intelligences? Integrating social, emotional and practical intelligence. In R. Bar-On, & J. D. A. Parker (Eds.), *The handbook of emotional intelligence* (pp. 136-168). San Francisco: Jorsey-Bass.

Hettich, P. (2000). *Transition processes from college to career*. Washington: American Psychological Association.

Jaeger, A. (2003). Job competencies and the curriculum: An inquiry into emotional intelligence in graduate professional education. *Research in Higher Education*, *44*(6), 615-639.

Jennings, P. A. & Greenberg, M. T. (2009). The Prosocial Classroom: Teacher Social and Emotional Competence in Relation to Student and Classroom Outcomes. *Review of Educational Research*, *79*(1), 491-525.

Kassem, C. L (2002). Developing the teaching professional: what teacher educators need to know about emotions. *Teacher Development*, *6*(3), 363-372.

Koman, E. S. & Wolff, S. B. (2008). Emotional intelligence competencies in the team and team leader: A multi-level examination of the impact of emotional intelligence on team performance. *Journal of Management Development, 27*(1), 55-75.

Landa, J. M. A., Lopez-Zafra, E., Martinez, R., & Pulido, M. (2006). Perceived emotional intelligence and life satisfaction among university teachers. *Psicothema*, *18*, 152-157.

Lopes, P. N., Coté, S., Grewal, D., Kadis, J., Gall, M. & Slovey, P. (2006). Emotional intelligence and positive work outcomes. *Psicothema*, *18*(Suppl.), 132-138.

Matthews, G., Zeidner, M., & Roberts, R. (2003). *Emotional intelligence: Science and Myth*. Cambridge: MIT Press.

Mayer, J., Caruso, DR., & Salovey, P. (2000). Emotional intelligence meets traditional standards for an intelligence. *Intelligence, 27*(4), 267-298.

Mayer, J., Caruso, DR., Salovey, P., & Sitarenios, G. (2003). Measuring emotional

intelligence with the MSCEIT V2.0. *Emotion*, *3*(1), 97-105.

Mayer, J. D., Roberts, R. D., & Barsade, S. G. (2008). Human Abilities: Emotional Intelligence. *Annual Review of Psychology*, *59*, 507-536.

Mayer, J., Salovey, P., & Caruso, D. (2000). Emotional intelligence as Zeitgeist, as personality, and as mental ability. In R. J. Sternberg (Ed.), *Handbook of emotional intelligence* (pp. 92-117). San Francisco: Jossey Bass.

Mora, J. (1997), Empleo y cualificación tras la educación postobligatoria [Employment and qualifications after compulsory education]. *Tribuna de Economía,* 764.

Nunan, T., George, R., & McCausland, H. (2000). Implementing graduate skills at an Australian university. In S. Fallows & C. Steven (Eds.), *Integrating key skills in higher education: employability, transferable skills and learning for life* (pp. 183-200). London: Kogan Page.

Organisation for Economic Co-operation and Development (OECD). (2005). *The definition and selection of key competencies. Executive Summary*.Retreived form http://www.oecd.org/dataoecd/47/61/35070367.pdf.

Palací, F. J., & Moriano, J. A. (Coords.) (2002). *El Nuevo Mercado laboral: estrategias de inserción y desarrollo profesional* [*The new labour market: strategies for insertion and professional development*]. Madrid: UNED.

Palací, F. J. & Topa, G. (Coords.) (2002). *La persona en la empresa: iniciativas de integración y desarrollo* [*The individual in the company: initiatives for integration and development*]. Madrid: UNED.

Palomera, R., Fernández-Berrocal, P., & Brackett, M. A. (2008). La inteligencia emocional como una competencia básica en la formación inicial de los docentes: algunas evidencias [Emotional intelligence as a basic competency in initial training for teachers: some evidence]. *Revista Electrónica de Investigación Psicoeducativa*, *15*(6-2), 437-454.

Pérez, N., & Castejón, J. L. (2007). La inteligencia emocional como predictor del rendimiento académico en estudiantes universitarios [Emotional intelligence as a predictor of academic performance in university students]. *Ansiedad y Estrés*, *13*(1), 119-129.

Pesquero, E., Sánchez, M. E., González, M., & Martín, R. (2008). Las competencias profesionales de los maestros de Primaria [Professional competencies of primary school teachers]. *Revista Española de Pedagogía, 241*, 447-466.

Petrides, K. V., & Furnham, A. (2003). Trait emotional intelligence: Behavioral validation in two studies of emotion recognition and reactivity to mood induction. *European Journal of Personality*, *17*, 39-57.

Planas et al. (2000). Marché de la Compétence et dynamiques d'ajustement. *Les Cahiers du LIRHE*, 6.

Prahalad, C. K., & Hamel, G. (1990). The core competence of the Corporation. *Harvard Business Review*, May, 79-92.

Pug, E. V. (2008). Recognising emotional intelligence in professional standards for

teaching. *Practitioner Research in Higher Education*, *2*(1), 3-12.

Rozell, E., Pettijohn, Ch. E., & Parker, R. S. (2002). An empirical evaluation of emotional intelligence: The impact on management development. *Journal of Management Development*, *21*(4), 272-289.

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality*, *9*, 185-211.

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personal psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, *124*, 262-274.

Sheffield Hallam University. *Key Skills On-line* [www document]. Retreived from http://www.shu.ac.uk/keytokey/shucontens.htm.

Schutte, N. S., Malouff, J. M., Hall, L. E., Haggerty, D. J., Cooper, J. T., Golden, C. J., et al. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences, 25,* 167-177.

Sternberg, R. J. (2003). Reply to the book review on Practical Intelligence in Everyday Life. *Intelligence*, *31*(4), 395-408.

Sternberg, R. J., Castejón, J. L., Prieto, M. D., Hautamäki, J., & Grigorenko, E. (2001). Confirmatory factor analysis of the Sternberg Triarchic Abilities Test in Three International Samples: An empirical test of the Triarchic Theory. *European Journal of Psychological Assessment*, *17*, 1-16.

Sternberg, R. J., Prieto, M. D., & Castejón, J. L. (2000). Análisis factorial confirmatorio del Sternberg Triarchic Abilities Test (nivel H) en una muestra española: resultados preliminares [[Confirmatory factor analysis of the Sternberg Triarchic Abilities Test (level H) in a Spanish sample: preliminary results. *Psicothema*, *12*(4), 642-647.

Sutton, R. E., & Wheatley, K. F. (2003). Teacher's Emotions and Teaching: A review of the literature and directions for future research. *Educational Psychology Review, 15*(4), 327-358.

Tapia, M. (2001). Measuring emotional intelligence. *Psychological Reports*, *88*, 353-364.

Teruel, M. P. (2000). La inteligencia emocional en el currículo de la formación inicial de los maestros [Emotional intelligence in the curriculum for initial teacher training]. *Revista Interuniversitaria de Formación del Profesorado, 38*, 141-152.

Vanderberghe, J., & Huberman, A. M. (Eds.), (1999). *Understanding and preventing teacher burnout: A sourcebook of international research and practice*. Cambridge, UK: Cambridge University Press.

Van der Zee, K., Thijs, M., & Schakel, L. (2002). The relationship of emotional intelligence with academic intelligence and the Big Five. *European Journal of Personality*, *16*(2), 103-125.

Weare, K., & Gray, G. (2003). *What works in developing children's emotional and social competence and wellbeing?* Department for Education and Skills Research Report, 456. London: DfES.

Yoon, J. S. (2002). Teacher characteristics as predictors of teacher-student relationships:

stress, negative affect, and self-efficacy. *Social Behavior and Personality: An International Journal, 30*(5), 485-493.

Zeidner, M., Matthews, G., & Roberts, R. D. (2004). Emotional intelligence in the workplace: A critical review. *Applied Psychology. An International Review*, *53*(3), 371-399.

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The monograph, written by a group of five Slovenian experts: C. Peklaj, J. Kalin, S. Pečjak, M. Puklek Levpušček and M. Valenčič Zuljan, from the fields of educational and developmental psychology and teaching methods (didactics), deals with an area that is enjoying increasing attention, the area of teacher competencies. Teachers are regarded, perhaps too optimistically, as "a driving force of social development". One of the central problems is the question as to which competencies teachers need in order to promote students' overall development, enabling them to prosper in the complex world of tomorrow. Thus the main goal of the monograph is to contribute to a better understanding of the intricate relations between teachers' competencies, student achievement and their socioemotional development, through interrelated variables such as teaching methods, classroom climate and management.

The study starts with an integrated view of these complex relationships in the form of a theoretical model, continues with the presentation of theory and empirical findings in specific areas (student assessment of teachers' classroom management and teaching methods, student motivation and learning behaviour, the development of students' psychosocial skills) and finally tries to integrate the results into a unified picture.

The study is based on theoretical models stemming from previous research on variables that can influence students' achievement, beginning with teaching methods and including socio-motivational processes. Lately, the central concept of teacher competencies has been widely promoted in the European context, as well as in the Slovenian context (see pp. 43-47). Perhaps the text could also have mentioned some voices of dissent and critique of this concept if understood in a narrow and formalistic sense. There are fears that lists of obligatory competencies or "standards" could lead to an excessively bureaucratic control of teachers' work. On the other hand, the concept of

competencies, if taken seriously, reminds us that knowledge itself can not guarantee good teachers, as competencies are "complex action systems which include emotional and motivational areas" (p. 40) as well as attitudes and values.

Clusters of competencies most important for quality teaching have been defined and empirically verified in previous studies in Slovenia and abroad, studies that have included teachers, student teachers, teacher educators and school heads. Areas of better developed and less developed competencies have been identified, with serious implications for teacher education. The text reminds us that there is still great diversity among EU Member States in approaches to defining teachers' competencies, in spite of attempts to define a common reference framework as a basis for teacher education. Therefore, empirical studies like the present one can contribute to a common understanding of teachers' competencies important for achieving good results in the cognitive domain as well as in the overall development of students.

The empirical part of the study is a good example of an integrated approach to the investigation of the effects of teachers' competencies. It approaches this complex area by combining the students' perspective (how they perceive the competencies their teachers manifest in everyday teaching and interpersonal behaviour) and some student traits, such as motivation and classroom behaviour, as viewed by the teacher. The main problem was to identify their relation to student achievement (in maths and Slovene language).

The study is based on a solid methodology regarding sampling, instruments and statistical analysis. Questionnaires *for* students and *on* students (completed by the teachers) were used, all with good reliability and other characteristics. These questionnaires were partly taken from other studies and partly constructed for the purpose of this study. The sample consisted of 470 students from the 7th and 8th grades of primary school and 473 students from the 3rd grade of general secondary school - gymnasium (the term "primary school" in this context can be misleading as students are 14 years old – in other school systems, this is "lower secondary school"). The teachers of these students were also included – 13 teachers of maths and 14 of Slovene language in the "primary" school and 10 maths teachers and 10 teachers of Slovene language in the secondary school.

The main results are presented and interpreted in a clear and systematic way. Only some of the more interesting results will be mentioned here. Some of the results give a fairly good picture of prevailing

teaching methods as viewed from the students' perspective. Items characteristic of transmission teaching (clear presentation, giving good examples, allowing clarifying questions) get relatively high average grades by the students, whereas those aiming to activate students (project and group work, classroom discussions) hardly exceed 2 points on a 4-point scale. About one half of students believe that teachers rarely or never connect teaching with real life experiences or encourage connections between subjects. The situation in primary school is better than that in secondary school, and the situation in Slovene is better than that in maths.

The active participation of students is not encouraged in the process of assessment either - for example, there is very little student self-assessment. Teachers rarely explain how students can improve their learning, but criteria for individual grades are relatively well explained.

In terms of quality classroom management (supportive learning climate, building mutual trust, etc.) and promoting the overall development of students (encouragement to help one another, to listen to one another, to assume responsibility, etc.), the results show that there is still room for improvement: grades under 3 on a 4-point scale prevail. The teachers received the lowest grades in the competent use of ICT in the classroom; it seems that the younger generation is ahead of them in this respect.

Results show that teachers are well prepared in advance, but not flexible enough and not sufficiently responsive to students needs in classroom situations; they could activate students more and connect teaching with real-life, authentic situations more often. This requires a thorough reflection on subjective theories – is a teacher primarily a presenter of knowledge or a moderator of active learning in their students? Analysis of student motivation shows that they are oriented toward the mastery of subject matter, but high results were also registered regarding test anxiety and the avoidance of mistakes, as mistakes are not regarded as a necessary part of all learning.

Numerous significant correlations were found between perceived teacher management and the desired behaviour in students; an open, supportive classroom climate resulted in less hostile, aggressive behaviour, which again meant better school achievement.

Finally, a path analysis model attempted to integrate all of the results. It confirmed the indirect influence of classroom management on students' achievement - teachers can influence students' achievement

primarily through motivating and activating desirable behaviour. This fact is often overlooked by "academically" trained teachers and teacher educators, who overstress the importance of teachers' subject matter knowledge and try to get better results by direct pressure to higher achievement and setting higher curricular standards. The fact that many Slovene teachers neglect the "relationship" aspect of their role was evident from the results of PISA 2009: student ratings of their teachers were, compared to other countries, near the bottom on items such as: "Teachers do not listen to us", "Teachers do not seem to care about us".

So the main message of this important monograph reads: Yes, academic pressure is important, but in the context of a safe and supportive learning environment, with meaningful and clear structuring of learning tasks and formative feedback, directed towards student improvement and supported by the teacher's belief that the student can learn and achieve; the teaching process has to be focused on the maximal use of each student's potential to learn. By mastering all of these competencies together (which is not easy), the teacher can positively influence the student's self-efficacy and mastery goal orientation – and these characteristics will have a direct influence on the desired social and academic behaviour that leads to better school achievement of students. This is also in line with the message of the recent OECD publication on the nature of learning. Among "core principles" for designing a powerful learning environment are mentioned: "The environment is founded on the social nature of learning" and "The learning professionals should be highly attuned to the learners' motivation and the key role of emotions in achievement". (Dumont et al., 2010, p. 321).

The study also offers an important lesson for preservice and inservice teacher education, which should be centred not only on better subject matter knowledge – as important as this is - and not only on teaching skills in a narrow sense, but also on competencies such as: how to create a favourable group climate, how to listen to and respond to students, how to manage undesirable behaviour and promote learning strategies. These aspects are too often overlooked in teacher training, especially at secondary level, as they cannot be "transmitted" directly but only through reflective practice, good mentorship, collegial learning and inside schools as "learning communities". The Bologna renewal of teacher education curricula gives us an opportunity to improve teacher education, but it cannot in itself guarantee this improvement.

The style of writing is clear and not unnecessarily complicated.

In some cases, terminology could be improved; for example, "team teaching" actually means "group work" of students; "examinations" of students could be replaced by "assessment". The problem of naming 14-year-old students as belonging to "primary school" has already been mentioned. Also, besides the author and subject index, which are included at the end of the monograph, a complete list of references for the whole text would be helpful to the reader, not only lists at the end of each chapter.

The publication is well worth reading by anyone interested in better understanding the intricate role of teachers' competencies and in improving them.

References

Dumont, H., Istance, D., Benavides, F. (Eds.) (2010). *The Nature of Learning. Using Research to Inspire Practice.* Pariz: OECD. (read only edition)

PISA 2009 Report: Programme for International Student Assessment. www.oecd.org/edu/pisa/2009.

Henderson, N. (Ed.) (2007). *Resilience In Action: Practical Ideas for Overcoming Risks and Building Strengths in Youth, Families, and Communities*. Paso Robles, CA: Resiliency in Action, Inc. 248 p., ISBN: 0-9669394-3-3.

Reviewed by Mag. Vanja R. Kiswarday, University of Primorska

Nan Henderson, M.S.W., *is an internationally recognized author, trainer, and consultant on fostering human resiliency in youth, adults, families, and organizations. Her publications on this subject are used in more than 25 countries and have been translated into Spanish and Russian. She is co-founder and President of Resiliency In Action, Inc., a training organization in Southern California. She has been a trainer for hundreds of school districts, and social service and community agencies. The PA Dept. of Education has recently mandated Ms. Henderson's resiliency model to be used in every PA school.*

The precedent for a paradigm shift from risk to resilience is emerging in the scientific literature as a consequence of the inadequate effectiveness of deficit models, on the one hand, and, on the other hand, as an answer to a challenge of longitudinal research evidence showing that, despite high risk status or exposure to adversities, about one third of children manage to succeed, to function positively and to successfully adapt to life (Masten & Powell, 2003, p. 2). The phenomenon has been defined as resilience - an inherent or fostered capacity or response mechanism within all individuals, organisations and communities that is used to overcome significant challenges (Ibid, p. 4). Protective factors or mechanisms are influenced by three major domains: individual personality attributes or dispositions, family characteristics, and environmental influences (exosystems, e.g., peers, school, community). An individual, especially a child or young person, daily participates in many different systems (family, school, cultural, recreational, social, religious environments) that mutually interact with his/her development. Due to such reciprocal associations and the diverse influences on the child's development and adjustment status across different systems, the resiliency theory framework is guided by Bronfenbrenner's ecological theory (Luthar, Chichetti & Becker, 2000,

p. 554). In regard to Bronfenbrenner's bio-socio-ecological model, all of these systems interdependently interact with each other. Thus risk and protective factors operate across settings and at different levels in different environments (Masten, 2008; Clay, 2005). This confers a responsibility to foster resiliency in the school system as one of most important systems for children and young people, as well as for the community at large.

Among several models that promote resilience Henderson's Resiliency model most coherently addresses the aims, objectives and guidelines of quality education recommended by the European Parliament and the Council ("Progress towards the Lisbon objectives in education and training", 2005) and national educational policy (ZOsn-F, 2007). The model emphasizes the process and aspires to create and provide quality environmental conditions within the school context, that promote equality, inclusion, learning efficiency, the importance of acquiring life skills and key competences for lifelong learning. When these environmental conditions are strengthened they also take the role of environmental protective factors and mechanisms for students.

The book *Resiliency in Action* aims to share and promote practical means and evidence derived from recent scientific research findings on resiliency. Contributors with different backgrounds and experience with resiliency (scientific researchers, professionals, individuals, schools, and communities) challenge the deficit-based approach towards a paradigm shift that fosters resiliency approach and focus sights on communicating "What is right with you is more powerful than anything that is wrong with you" (p. vi). Contextually, the book is divided into seven parts: The Foundations of Resiliency; Resiliency and Schools; Resiliency and Communities; Resiliency Connections: Mentoring, Support and Counselling; Resiliency and Youth Development; Resiliency and Families; and Resiliency and the Brain.

From the six chapters within **Part One**, we can gain an insight into the foundations of resiliency. Researcher Bonnie Benard introduces readers to the fundamental research that has enabled scientists to identify the correlates and markers of good adaptation among young people at risk. An important finding for prevention and education is that resiliency is not a generic trait but rather an inborn capacity for self-righting, transformation and changes that needs to be guided and supported through development. Ideally, a resilient attitude should become a way of living, because fostering resiliency

operates at a deep structural, systemic, human level that is communicated via relationships, beliefs, mutual interaction and opportunities for participation. Benard emphasises the importance of focusing on the process rather than on the programme. Further, Nan Henderson presents the Resiliency Model, based on the research findings of individual and environmental protective factors and mechanisms. She has designed the Resiliency Wheel, a set of strategies that can be implemented in various circumstances to foster resiliency. She considers the Caring and support factor to be the most valuable and fundamental of all of the protective factors in the Resiliency Wheel, as it enables the creation of the relationships and environment that genuinely care for the child. It represents the base from which all of the other five factors emerge: High, but realistic, expectations for success; Opportunities for a "meaningful contribution" to others; Positive bonds and connections; Clear boundaries; and Life skills. The Caring and support dimension is strongly connected with learning engagement, efficiency and competence gathering. We can agree that the Resiliency Wheel seems logical and in full accordance with modern education curricula, but the evidence of the low learning motivation, low efficacy, numerous mental health problems among young students, bullying, school dropouts, etc., that appear so frequently in everyday school practice does not reflect this logical accordance. As Galimberti (2010, pp. 27-47) points out, there is a major lack of emotions, relations and connectedness in our schools. Students remain untouched, unchallenged and uninvolved if the learning process passes them by without engaging both emotion and cognition. We can critically ask ourselves as teachers and adults: Are we giving students enough opportunities to participate in an active and creative way? Where else are students testing and using their acquired knowledge and skills besides in formal assessments? We encounter so many problems with discipline, inappropriate, even aggressive behaviour; it is difficult to respect the rules if there is simply a lack of respect for people and positive relations. It happens so often that teachers strongly support knowledge rather than students! In such circumstances the Resiliency Wheel may serve perfectly as a guideline for rethinking educational practice, aims and priorities.

Dr Emmy Werner is one of the pioneers in the field of resiliency research. After over 30 years experience of longitudinal studies she notes a tendency toward fostering resiliency and a great deal of interest in this field. However, she warns us to be prudent in determining whether and when someone is resilient, and with regard to

our expectations related to this. She is sceptical about the effectiveness of short programmes that aim to foster resiliency, but she looks forward to a common strength-oriented mindset that fosters resiliency. Research evidence show that resiliency is not fixed and stable but that it changes through time and different situations, even within an individual as he or she develops. Competences and success in salient developmental tasks are crucial for positive adaptation, and later for positive self-confidence. This interconnection of individual and environmental protective factors and mechanisms reflects the important role of schools, or rather teachers. The latter appear as important adults who "provide children with a secure basis for the development of trust, autonomy, initiative and competence" (p. 23) and have good opportunities to make a difference and shift a child from risk to resiliency. The theory is followed by profiles of two young people who demonstrate resiliency in their life experience, as well as a strength-based approach to interventions with children exposed to domestic violence.

In the nine chapters in **Part Two**, resiliency is surveyed in a school context through research that forms the basis of a model of effective school reform. Educational changes and resiliency-building factors both take into account and seek to improve the same educational aspects (school's purpose, the nature of knowledge and learning, teaching methods, curriculum, leadership, decision making and assessment - see scheme, p. 61). Henderson presents extensive validation of the Resiliency Wheel, which, by addressing six protective environmental conditions, promotes improvement of school climate, provides opportunities for social-emotional learning and key competence gathering, and supports the development of students' resiliency. Like a great deal of other research on effective learning, the research in question shows that the way students experience their school day affects student achievement just as much as the academic aspect does. Thomsen, who perceives schools and good educational practice as potentially ideal settings where positive youth development becomes inherent, underlines the importance of brain-based intelligence, the employment of multiple intelligences and learning style awareness, character building, service-learning, peer leadership, cooperative learning and the mentoring approach. Henderson exposes the power and prevention effect of focusing the common opinion and norms toward positive goals, by simply refocusing data to emphasise positive behaviour instead of warning about negative examples (Chapter

8). Every educational process, especially when implementing new approaches (e.g., Resiliency-Building Approaches to School Discipline, presented in Chapter 6, and Changing Student Attitudes and Behaviours with Policy Revision in Chapter 7), should be constantly evaluated. In Chapter 3 of Part Two, Noonan and Henderson point out that the evaluation of different aspects of the programme "should be a regular ongoing endeavour in every school" (p. 51); they then introduce educators to a step-by-step guide to designing proper research and to improving programmes according to the evaluation the results of various aspects of the programme.

In the eight chapters of **Part Three**, the most successful programmatic approaches to fostering resiliency within the community are presented. They all express the value of connecting, networking and including various resources to influence community wellbeing and to raise the level of children's and young people's competences, interpersonal relations, mutual help, collaboration and care. The community, particularly educators, needs to support "the value of the application of knowledge over the mere acquisition of knowledge" (p. 86). If we want to raise responsible people we need to give children and young people opportunities to be responsible, opportunities that challenge their talents and capacities, not only their needs, because what gives them confidence and strength is the sense that they can do something for the others, for the community.

The twelve chapters in **Part Four** focus on creating connections in the sense of mentoring, counselling and support. Sustained relationships and close bonds form one of the fundamental conditions in fostering resiliency. Many research findings highlight that positive relations in the school context have an important influence on the school climate, which strongly correlates with school discipline, learning motivation and consequencely learning effectiveness. "Relationships must be the top priority in any prevention effort or educational reform" (Benard, p. 115), accompanied with effective mentoring programs, supervision and support, especially when volunteers are involved.

Part Five invites us to reconsider resiliency and youth development in a wider sense in order to form a Positive-focused framework for youth, aimed at encouraging their energy, enthusiasm, creativity, morality and caring for the world. Dynamic models are a step forward from "diagnose the problem" models; they enrich the concept towards searching and opening new opportunities for the individual's active approach and for further development, instead of just focusing on

problem solving. It is again emphasised that such a paradigm shift is important. Dr Benson compares three major American projects: Resiliency, Youth Development, and Asset Development, identifying numerous complementarity factors among them: they all share the same intellectual space, but differ in strategies and target populations. Henderson disputes the statement that resiliency is aimed exclusively at the "at risk" populations, exposing the "high risk and uncertain nature of the world children and youth encounter today, which contributes to the requirement of resiliency for all kids" (p. 169). A great deal of research (e.g., Search Institute research, 1996) highlights a lack of assets in child development in the face of the problems that children encounter daily, in spite of the fact that research shows the significant impact of developmental assets on risky behaviours (p. 175). Henderson also emphasises the growing need to infuse the resiliency attitude, which she summarises as a "strength-based philosophy" (p. 170), across the continuum of all programmes. Instead of labelling people she advocates a resiliency research-based belief: that everyone, irrespective of age, has an innate capacity to bounce back. The next step is to identify and expand individual patterns, so-called resiliency builders that can be used to overcome challenges.

In the nine chapters in **Part Six**, the authors examine how resiliency can be implemented in families. The family represents the most powerful system in child development, which can be both a protective and a risk factor source. Throughout all of the chapters the importance of strength-focused approaches in family therapy in order to positively meet life's challenges is emphasised, since many research findings show (e.g., Wolin's research on transmitter and non-transmitter families, ***Wolin*** & Bennett, 1984) that even the most troubled families sometimes strongly support children. Both scientists and practitioners of various fields (medicine, education, social sciences) point to the powerful language of damage that has arisen in describing people and their disorders over the years and call for the enrichment of the vocabulary of strengths (p. 195). Such a tendency is also emerging in Slovenian social and educational science, where Dr Gabi Čačinovič Vogrinčič is one of the most enthusiastic advocates of a strength-focused approach and vocabulary that comprise energy, starting points and guidelines for problem solving and managing crises and conflicts (e.g., Čačinovič-Vogrinčič, 2009). Some research-based parenting programmes are presented in subsequent chapters, given that as adults, whether inside

or outside the family, our attitudes and choices are powerful determining factors for the future of our children and youth.

There are still new challenges and open questions in resiliency research arising with new findings in neuroscience, genomics, biology, statistics, and the modelling of the development in complex systems, as we can read in scientific reviews (Masten & Obradović, 2006, p. 23). The eight chapters in the **last part** of the book look forward to the so-called fourth wave of resiliency research, which focuses on integrating the study of resiliency across levels of analysis, species and disciplines. One of the leading scientists in the field of resiliency, Ann Susan Masten, anticipates Integrative research and collaboration among scientists, which promises to open up new opportunities for basic and applied research. With a transdisciplinary approach we may expect researchers to reveal a much deeper insight into the plasticity of adaptive functioning itself, as well as developing a greater understanding of how processes work within and across levels to nurture resiliency in children.

A neuroscientist Peggy La Cerra, Ph.D., explains how human minds are absolutely unique and multidimensional, and that they constantly change and adapt to the environment. She disputes the term "bouncing back" and remarks that "human brains never return to a previous state but are designed by nature to change with every experience in response to feedback from the environment" (p. 226). Her understanding of resiliency is that it symbolises the "mind that is responding in a way that will enable an individual to thrive in society in large" (p. 226). The other important matter that she exposes is the negative effect of labelling, even positive labelling. Labelling is in direct contradiction to the dynamic and constantly adapting nature of the brain, the mind and the self, therefore cannot be a supportive charge in any case, either for the "at risk" or "gifted" population. She again places emphasis on the value of caring adult support of the child's intrinsic value and potential, which have the power to move the brain, mind and self in the direction of generating successful behaviours. Inspired by Newcomb's article "Adolescence: Pathologizing the Normal Process" (1996), and following Erickson's developmental crisis, in Chapter 3 Trout takes a resiliency-based view of adolescence, and explores the strengths perspective of creating solid identity in this developmental phase, which is characterised by multi-level transition processes. All of the further chapters are based on the resilient brain, which turns out to be a natural trait for all humans. Brendtro

and Longhurst introduce brain-based strategies that facilitate turning problems into opportunities in Chapter 4. In Chapter 5, the authors invite us to rethink the powerful role of music and music making, something that still attracts a great deal of interest in scientific research of the development of essential cognitive systems (reasoning, creativity, thinking, decision making, problem solving). Henderson emphasises the need and value of play and unscheduled free time, which clearly arises from the neuroscientific aspect, in Chapter 6. She refers to the American Academy of Paediatrics (AAP) Report in 2006, which warned against reducing children's free-time play and physical outlets. Based on recent research findings that point to the predicted and unanticipated contribution of play to education and child development, we can understand play as one of the basic developmental urges, besides sleep, rest, and food; "play, movement, fun, art, creativity, and loving interpersonal interactions filled with sharing pleasurable time together, along with effective and developmentally appropriate discipline are the true predictors of childhood serving as a springboard toward the happy successful adulthood" (p. 243). Finally, in Chapters 7 and 8, the supportive role of Brain Gym movements is highlighted; Brain Gym, developed by Dennison in the early 1980s, is recognised as one of today's leading technologies for education. Brain Gym movements and activities help to strengthen neural connections all over the brain and rebalance brain patterns that have "downshifted in lower, survival brain areas", explains Peterson (p. 246). These findings are especially important for the education of children with special needs, who very often develop into stressed and anxious individuals; they provide an opportunity to facilitate and harmonise the functioning of the individual's mind and body system.

As Benson, Ph.D., remarks in the foreword, the book Resiliency in Action results as a fine combination of theory and practice that makes knowledge and understanding of resiliency paradigm more accessible by challenging reader's head and heart.

References

Benard, B. (1991). *Fostering Resiliency in Kids: Protective Factors in the Family, School, and Community*. Retreived May, 12, 2009 from http://hopeworks.org/formation/documents/FosteringResiliency.pdf.

Čačinovič Vogrinčič, G. (2009). *Soustvarjanje v šoli : učenje kot pogovor.* Ljubljana: ZRSŠ, 2009.

Clay, V. (2005). *The Resilience Identification Resources project: a strengths based approach*

to protective and risk factors. 10th National Conference of the Association for the Welfare of Child Health. Retrieved April, 14, 2009 from http://www.awch.org.au/pdfs/conferences/2005/04_%20Clay%20resilience_paper.pdf.

European Commission (2007). *Progress towards the Lisbon objectives in education and training*. Retreived February, 14, 2011 from http://ec.europa.eu/education/policies/2010/progressreport_en.html.

Galimberti, U. (2010). *Grozljivi gost: nihilizem in mladi*. Ljubljana: Modrijan

Masten, A. S., & Powell, J. L. (2003). A resilience framework for Research, Police and Practice. In S. Luthar (Ed.), *Resilience and vulnerability*. New York: Columbia University.

Luthar, S., Chichetti, D., & Becker, B. (2000). The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work. *Child development, 71*(3), 543-562.

Magajna, L. (Ed.) (2008). *Učne težave v osnovni šoli: problemi, perspektive, priporočila*. Ljubljana: ZRSŠ.

Marzano, R. J. (2003). *What works in schools: Translating research into action*. Alexandria, VA: Association for Supervision and Curriculum Development.

Masten, S. A., & Obradović, J. (2006). Competence and resilience in development. In *Ann. N.Y. Acad. Sci.* 1094 (pp. 13–27). New York Academy of Sciences. doi: 10.1196/annals.1376.003

Zakon o organizaciji in financiranju vzgoje in izobraževanja. *Uradni list RS*, nu. 12/1996.

Zakon o organizaciji in financiranju vzgoje in izobraževanja-UPB5. *Uradni list RS*, nu. 16/2007.

Zakon o organizaciji in financiranju vzgoje in izobraževanja. *Uradni list RS*, nu. 101/2007.

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